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THE
SCIENCE AND PRACTICE OF MEDICINE

THE
SCIENCE AND PRACTICE
OF
MEDICINE

BY

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IN TWO VOLUMES

VOL. I

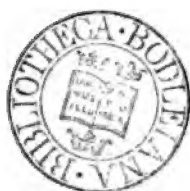
Second Edition, Revised and Re-written

LONDON
CHARLES GRIFFIN AND COMPANY
STATIONERS' HALL COURT
1863

[The Author reserves the Right of Translation]

~~150. a. 123.~~
151. a. 281.

BELL AND BAIN, PRINTERS, GLASGOW.



TO

SIR JAMES CLARK, BART., M.D., F.R.S.,

Physician in Ordinary to the Queen.

MY DEAR SIR JAMES,

It gives me sincere pleasure to be permitted to dedicate the Second Edition of this Work to you.

If the expression of private regard could add point to a Dedication which I ask you to accept upon public grounds, I have ample reason gratefully to acknowledge my personal obligations to you for many acts of kindness and friendship which I never can forget.

But this Work is intended for the instruction of Students of Medicine; and were it necessary for me to justify the selection of your name, long ago honourably stamped by the confidence of our Most Gracious Sovereign, and by the unanimous consent of our Profession, I find many appropriate public grounds for asking you to accept this Dedication:—

First, On account of the deep and unceasingly active interest you have taken in the improvement of Medical Education throughout a long and arduous professional life.

Second, That by writing, and the example of your practice, you have done much to advance our knowledge of CONSTITUTIONAL DISEASES; invariably inculcating, especially in your now classic works on Climate and Consumption, the Hygienic management of the system from the very commencement of infant existence.

Third, That the Student of Medicine should have held up to him

the brilliant example which you have shown of an unswerving adherence in practice to those doctrines of Pathology which rest on Physiology and the Laws of Health as their basis—doctrines and principles which have led you to take an active share in the advance of Sanitary Science and the progress of Medicine, thereby elevating the character, extending the scope, and increasing the usefulness of our Profession, and which have placed you on the very summit of professional honour.

That you may long live to enjoy that honour, the confidence of our Most Gracious Queen, and that happiness and reputation which are the highest rewards of a useful and well-spent life, is the fervent desire of,

Yours most respectfully and sincerely,

WILLIAM AITKEN.

ROYAL VICTORIA HOSPITAL,
NETLEY, *September*, 1863.

PREFACE TO THE SECOND EDITION.

IN preparing a Second Edition of the **HANDBOOK OF THE SCIENCE AND PRACTICE OF MEDICINE** the Author has endeavoured, without material alteration in the general scheme of the Work, to render it more deserving of the confidence of the Student.

The extensive sale of the First Edition, as well as the unsought testimonies to its usefulness which the Author has received from many teachers and practitioners of Medicine previously unknown to him, have satisfied the Author that the Work has met the want it was mainly designed to supply—namely, a Text-book for Students, following a systematic arrangement which would give them a consistent view of the main facts, doctrines, and practice of Medicine, in accordance with the present state of the Science.

That the Work should have been so favourably received demands the most grateful acknowledgments of the Author.

The several sections composing the introductory portion of the former edition have been somewhat expanded by the addition of important topics relative to Pathology; and, with a view to follow a more natural order in the treatment of the subject, the introductory sections of the former edition now form Part I. of this Text-book, and as such are still to be considered as introductory to the succeeding parts.

The whole Work has been carefully revised throughout; numerous additions have been made where topics of importance had been only shortly noticed before; and the paragraphs on the prevention and treatment of diseases have been more fully expressed. The Work, indeed, has been almost entirely

re-written; and descriptions of many diseases, omitted in the former edition, are now introduced.

Although still adopting in the main the nomenclature and classification used by the Registrar-General and by the Army Medical Department, yet there are some diseases (such, for example, as *Rheumatism*, *Chronic Bright's Disease*, *Diabetes Mellitus*, and the like) whose pathology now forbids their being considered in the place where they are respectively found in that classification; but otherwise, for the reasons stated in Part II. (and especially between pages 169 to 174), that nomenclature and classification have both been retained as the fundamental part of the system on which the arrangement of the Text-book is based.

Diagrams illustrative of the typical ranges of temperature in febrile diseases are now given for the first time in a Text-book. The Author has been induced to do this from a belief in the great practical importance of the subject, and in the hope that it may lead those who have opportunities for original observation to add to our knowledge of febrile diseases in this direction. These diagrams have been introduced advisedly, after consultation with one who has had great experience as a clinical teacher, and for whose opinion the Author entertains a most profound respect.

Wood-cuts have been introduced wherever it was thought they would render the descriptions in the text more intelligible; and short sections, relative to the main points to be attended to in clinical diagnosis, have been given at the heads of the chapters treating of those "diseases in the course of which lesions tend to be localized."

As with the compilation of the First Edition, so now, the Author has numerous obligations to acknowledge; and first of all, his best thanks are due to his esteemed friends and colleagues Professors Longmore, Maclean, and Parkes. To them he is indebted not only for advice on many points, but for information and material which he would not otherwise have had, and all of which he has endeavoured duly to identify and acknowledge at its proper place in the text.

The Author's thanks are also due to Dr. Sidney Ringer, the Professor of *Materia Medica* in University College, for the use of his Notes on the ranges of temperature in cases of *Rheumatism*, and for permission to publish the details given in the text relative to temperature in that and in other diseases.

To his friend Dr. T. M. Anderson, of Glasgow, the Author owes his thanks for the use of wood-cuts illustrative of parasitic diseases of the skin; and to his friend Otto Striedinger, Esq., the Secretary of the Army Medical School, the Author is indebted for many excellent drawings, as well as for other valuable assistance.

Agreeably to facts and doctrines set forth in the second volume of the *Ophthalmic Hospital Reports*, pp. 117 and 120, the Author advised that these volumes should be printed on paper of a yellowish tone; and his thanks are due to the printers for the care, ability, and skill with which the typography of a text containing so many terms purely scientific has been executed.

ROYAL VICTORIA HOSPITAL,
NETLEY, September, 1863.

PREFACE TO THE FIRST EDITION.

IN the compilation of this HANDBOOK I have attempted to give a condensed view of the SCIENCE AND PRACTICE OF MEDICINE. It has also been my object to incorporate and connect the more recently established facts which illustrate the *Nature of Diseases* and their *Treatment* with the time-honoured doctrines on which the Science of Medicine has been based.

While the greater portion of the volume is necessarily devoted to a consideration of the *Nature* and *Treatment* of individual diseases, a more comprehensive range of topics has been embraced, under the title of the SCIENCE OF MEDICINE, than it has hitherto been usual to include in text-books.

The introductory sections indicate the more important elements of *General Pathology*; and those principles are shortly stated on which the more modern systems of *Nosology* have been founded since the time of Cullen.

The remainder of the volume, arranged in three divisions, treats, in the FIRST PART, of *Systematic Medicine, Nosology, or the Classification of Diseases*, and suggests that the classification of the Registrar-General of England should be adopted. This statistical nosology, originally proposed by Dr. William Farr, has been carefully discussed and revised at the recent meeting of the Statistical Congress held at Vienna, and a *nomenclature* substantially the same is proposed for adoption in all the States of Europe. The fatal cases are to be *registered* on a uniform plan. A definite *classification*, however, is still undetermined; but I am kindly informed by Dr. Farr that a *classification* nearly the same as the English one has been adopted in Bavaria, and is quietly making its way among practical men in Germany. The

Austrians, also, as represented by Dr. Hebra, approve of the separation of *Zymotic* diseases from the others.

In PART SECOND, under the head of the *Nature of Diseases, Special Pathology and Therapeutics*, I have attempted to describe the nature of each disease, considered as characteristic of its class. In so doing each disease or morbid process has been defined, not by a logical definition, but merely by stating prominently its leading characters, so that the student may *at once* distinguish the general features of the disease which he has to study, and which the physician has to treat. Having then established the position of each disease in its *Nosological* and *Pathological* relations, those principles are stated which guide its treatment, and in some instances definite details are given.

In PART THIRD, under the head of *Medical Geography*, or the *Geographical Distribution of Health and Disease*, a prominent place has been assigned to a most important department of the Science of Medicine—a subject of study hitherto, so far as I am aware, wholly untaught at our medical schools in this country. It was emphatically written by Cabanis and Malte Brun that climate and natural history lost much of their value from the fact that the physical conditions of the surface of the earth had not then been described in relation to these studies—a deficiency now in a great measure supplied by the labours of Humboldt, Berghaus, and Johnston. So also it may be stated that the NATURE OF DISEASES and their distribution on the globe require that they should be studied in relation to the physical condition of the earth's surface, and to the variation of their *types* in the different regions of the earth. The geographical distribution of Health and Disease in relation to Physical Geography is a branch of the Science of Medicine rapidly and justly growing in importance, and in one department—that of *Sanitary Science*—is beginning to yield most important fruits. To Dr. Mühry in Germany, M. Boudin in France, and Mr. Keith Johnston in this country, the Science of Medicine is largely indebted for the elucidation of this important topic; of which I have attempted to give a sketch, illustrated by Mr. Johnston's map, indicating some of the more useful directions which the study may take.

In my attempt to accomplish this design I have many obligations to acknowledge. In the first instance, the work has its origin in an Article on the "Elementary Principles of Medicine," contributed to the *Encyclopædia Metropolitana* by the late Dr. Robert Williams, a distinguished physician of St. Thomas's Hospital, London. This Article contains the elements of his classic work on *Morbid Poisons*, completed about sixteen years ago—a work which "occupies the highest rank in the practical literature of this country;" and his views regarding their nature are here preserved, commencing from page 185 of this Text-book. It was originally intended by my publishers to reproduce that Article, but I deemed it necessary entirely to re-write and re-model the whole, retaining the statements of facts, and such illustrations as appeared to be of sufficient importance. While I have collected information from every other available source, the limits of this volume prevent me doing more than simply stating at the end of each paragraph the name of the author from whose writings the statements have been compiled. If I have correctly interpreted and stated the doctrines taught by the veteran labourers and original investigators in the fields of medical experience and research, the names of those of whose writings I have freely and largely availed myself will furnish a sufficient guarantee that the matter I have attempted to communicate is at least orthodox. Much valuable material I have also to acknowledge from anonymous contributors to the pages of the *Medical Journals*. For access to books and libraries I beg especially to express my thanks to Dr. Sieveking, Mr. Martin, Sir James Clark, Dr. Steele, and to the Library Committee of the Royal College of Surgeons. Lastly, my best thanks are due to Dr. Steele, Superintendent of Guy's Hospital. Notwithstanding the unceasing demands upon his time which the onerous duties of his office entail upon him, he has kindly revised the sheets as they passed through the press;—for their numerous imperfections I alone must bear the responsibility.

LONDON, 12th October, 1857.

CONTENTS.

PART I.

TOPICS RELATIVE TO PATHOLOGY.

CHAPTER I.

	PAGE
OF MEDICINE AS A SCIENCE AND AS AN ART: ITS OBJECTS AND ITS EXTENT,	1
The Science of Medicine embraces a Study of—(1.) Physiology; (2.) Pathology; (3.) Therapeutics; (4.) Hygiene,	2
The "Institutions" or "Theory of Medicine,"	2
Plan and Scope of the Text-book,	3

CHAPTER II.

HOW THE NATURE AND CAUSES OF DISEASES MAY BE ELUCIDATED,	4
Subjects of Clinical Instruction,	4
Topics of Special Pathology,	4
Science of General Pathology,	4
Subjects for Investigation by the Student,	4

CHAPTER III.

RELATIVE NATURE OF THE TERMS "LIFE," "HEALTH," AND "DISEASE,"	5
Definition or Meaning of the term Disease,	5
Meaning of the terms "Life" and "Health,"	5
What ought to be embraced by the Definition of any Disease in particular,	5

CHAPTER IV.

OF MORBID PHENOMENA, SYMPTOMS, AND SIGNS OF DISEASE,	6
Meanings attached to the terms " <i>Sign</i> ," " <i>Symptom</i> ," and " <i>Diagnosis</i> ,"	6
How a " <i>Diagnosis</i> " is made,	7
How a " <i>Prognosis</i> " is given,	7
Significance of " <i>Pathognomonic Signs</i> ,"	7
Methodical Examination of Patients necessary,	8
Works recommended for Study,	8

CHAPTER V.

	PAGE
MORBID ANATOMY AND PATHOLOGICAL HISTOLOGY ; THE SPECIAL MEANS AND INSTRUMENTS BY WHICH THE NATURE OF DISEASES MAY BE INVESTIGATED,	9
Physiology must be the basis of sound Pathology,	11
How the Science of Pathology is being advanced,	13
Characteristics of Medical Research in the present day,	17
Appropriate Use of Physical Aids to Diagnosis,	19
Elementary Constituents of Lesions,	21

CHAPTER VI.

THE ELEMENTARY CONSTITUENTS OF LESIONS AS SHOWN BY MORBID ANATOMY AND OTHER MEANS OF RESEARCH,	22
Methods of Determining the Nature of Diseases,	23
Various Forms of the Constituent Elements of Disease,	24
(A.) Morbid Elementary Products,	25
(B.) Complex Vital Processes whose Phenomena more or less combined constitute Disease,	26

CHAPTER VII.

COMPLEX MORBID STATES,	27
--------------------------------	----

SECTION I.—FEVER—*Pyrexia*.

Definition of Fever,	27
Pathology of Fever, and Phenomena which constitute the Febrile State,	27
Abnormal Generation of Heat in Fever,	29
Abstract of Dr. Parkes' Observations on Fever,	31
Destruction of Tissue in the Febrile System,	35
Condition of the Urine and of the Blood in Fever,	37
Causes or Influences which combine to produce the Complex Phenomena of Fever,	39
Diagnosis of Pyrexia, and Usefulness of the Thermometer at the Bed-side,	40
The Thermometer as an Aid to the Differential Diagnosis of Fevers,	41
I. Data relative to the Temperature of the Body as a Guide to the Pathological Value of regularly continuous Thermometric Observation, in the Diagnosis and Prognosis of Disease where Fever may be present,	42
Significance of Varying Temperature in Fever,	43
II. Practical Rules as a Guide to the regularly continuous Determination of the Temperature of the Body in Diseases where Fever may be present,	55

SECTION II.—INFLAMMATION.

Definition and Pathology of Inflammation,	58
Phenomena and Theory of the Inflammatory Process,	59
Experiments and Observations of Professor Joseph Lister,	60

CONTENTS.

xvii

	PAGE
Altered Supply of Blood to the Part in Inflammation,	60
The Phenomena of "Stasis,"	65
The Constitution of the Blood is altered in Inflammation as regards its adaptability to Nourish the part,	66
Objects of more Extended Inquiry regarding Inflammation,	69
The Causes of "Stasis" and of "Exudation,"	71
The Essential Nature of Inflammation,	73
Products, Effects, or Events of Inflammation,	75
Productive Effects of Inflammation, Inflammatory Effusions, or Exudations,	77
The Serum of Inflammation—Serous Effusion,	77
The Blood Effusions, or Extravasations of Inflammation,	79
The Inflammatory Lymph, or Fibrine of Inflammation,	80
Primordial Cell Forms in Lymph,	83
The "Compound Granule Cell," or "Exudation Corpuscle,"	85
The Nature and Growth of Pus Cells,	87
Formation of Pus—Suppuration,	88
<i>Parenchymatous and Secretory Inflammation</i> ,	93
Events which accompany or follow Inflammation,	93
<i>Softening</i> , or Diminished Cohesion of Tissue,	94
<i>Ulceration</i> , its Nature and Mode of Operation,	94
<i>Granulation</i> , its Nature and the Mode of Operation through which a Wound or Sore is Healed by it,	94
<i>Mortification</i> , its Nature and Occurrence in the <i>Humid</i> or <i>Dry</i> Form,	97
Local and General Symptoms of Inflammation,	98
(1.) Inflammatory Fever,	98
Circumstances which modify Inflammatory Fever,	101
(2.) Typhoid Fever as a Symptom of Inflammation,	102
(3.) Hectic Fever as a Symptom of Inflammation,	103

SECTION III.—DEGENERATIONS OF TISSUE.

Definition and Pathology of Degeneration,	106
(a.) Fatty Degeneration,	107
(b.) Mineral Degeneration, Calcification, or Petrification,	109
(c.) Pigment Degeneration—Pigmentation,	111
(d.) Amyloid or Albuminoid Degeneration,	114
Amyloid Degeneration has been long known and described under other names,	115
<i>Albuminoid</i> Nature of the so-called Amyloid Degeneration,	117
Characteristic Test of the Existence of Amyloid Degeneration,	119
General Characters and Anatomical Description of the Tissues which have undergone Amyloid Degeneration,	120
Appearance of Amyloid Degeneration in Organs,	121
Elements of Tissue in which Amyloid Degeneration has been Demonstrated, Origin of Amyloid Degeneration, and the Diseased States with which it has been found associated,	121
Signs or Symptoms associated with this Degeneration discoverable during Life,	124
Amyloid Degeneration common amongst Soldiers,	125

CHAPTER VIII.

TYPES OF DISEASE AND THEIR TENDENCY TO CHANGE,	1
Changes of Type occur in Epidemic Fevers,	
Medicine shown to be a Productive Art,	
Types of Disease are Modified by Complication with other Diseases, . .	
Types of Disease vary from time to time,	
Type of Inflammatory Fever changed,	
Elements of Congenital Degeneracy,	
Effects of Chronic Alcoholism,	
Varying Types of Disease prevail in Succession,	
View of the Subject entertained by Dr. Watson,	

CHAPTER IX.

MODES BY WHICH DISEASES TERMINATE FATALLY,	
Mode of Death by extreme Old Age,	
by Faint or <i>Syncope</i> ,	
by <i>Anæmia</i> ,	
by <i>Asthenia</i> ,	
by <i>Starvation</i> ,	
by <i>Suffocation</i> ,	
by <i>Coma</i> ,	

CHAPTER X.

PRINCIPLES WHICH DICTATE THE TREATMENT OF THE COMPLEX MORBID PROCESSES,	
1. As regards Fevers, or the Febrile State,	
How Fevers naturally terminate favourably,	
Principles which ought to guide the Treatment of Fever,	
2. As regards Inflammation,	
Principles which ought to guide the Treatment of Inflammation, . .	
General Rules relative to Blood-letting,	
The Influence of Purgatives and of Mercury in the Treatment of Inflammations,	

PART II.

METHODICAL NOSOLOGY—SYSTEMATIC MEDICINE; OR, THE DISTINCTIONS AND DEFINITIONS, THE NOMENCLATURE AND CLASSIFICATION OF DIS- EASES,	
---	--

CHAPTER I.

THE AIM AND OBJECTS OF NOSOLOGY,	
1. The DEFINITIONS of Diseases,	
Principles on which Diseases may be Defined,	

CONTENTS.

xix

	PAGE
2. The NOMENCLATURE of Diseases,	162
How Diseases are to be Named,	163
3. The CLASSIFICATION of Diseases,	164
Usefulness of Classification,	165
Principles on which Diseases have been Classified,	166
The Aim of "Natural" Systems of Classification,	171
Present State and Aim of Nosology,	171
Dr. Farr's System of Nomenclature and Classification,	172
Reasons why it ought <i>provisionally</i> to be accepted,	172
Imperfections of Dr. Farr's Method of Classification,	173

CHAPTER II.

TABULAR VIEW OF THE CLASSES AND ORDERS OF DISEASES ACCORDING TO THE NOSOLOGY OF DR. FARR,	174
---	-----

CHAPTER III.

TABULAR VIEW OF THE CLASSES, ORDERS, AND NOMENCLATURE OF DISEASES, ARRANGED ACCORDING TO THE ENGLISH, LATIN, FRENCH, AND GERMAN NAMES AT PRESENT IN USE,	176
Statement by Mr. Longmore, Professor of Military Surgery, on the Working of this Nosology as applied to the wants of the Military Medical Service,	183

PART III.

THE NATURE OF DISEASES: SPECIAL PATHOLOGY AND THERAPEUTICS.

CLASS I.—ZYMOTIC DISEASES.

CHAPTER I.

GENERAL REMARKS ON THE PATHOLOGY OF ZYMOTIC DISEASES,	185
The Physiological Modes in which Poisons act Illustrate by Analogy the Nature of Zymotic Diseases,	186
Specific Action of Poisons generally,	189
Specific Action of the Poisons which produce Zymotic Diseases,	192
Periods of Latency of Morbid Poisons,	193
Varying Effects of Morbid Poisons, and Peculiarities in their Modes of Action,	195
Mode in which Poisons Operate,	199
Morbid Poisons affect the Blood,	201
Deaths from Zymotic Diseases in this Country,	202
Four Orders comprehended under the Class of Zymotic Diseases,	203

CHAPTER II.

	PAGE
PATHOLOGY OF THE MIASMATIC ORDER OF ZYMOTIC DISEASES,	203
The Sources of Miasmatic Diseases,	203
Paludal Malarious Poison,	203
Animal Malaria Poisons or Effluvia,	204
Conditions Favourable to the Spread of Disease,	205
Specific Disease Poisons,	205

CHAPTER III.

ON THE NATURE OF ENDEMIC, EPIDEMIC, AND PANDEMIC INFLUENCES, .	206
<i>Endemic</i> Influences,	207
Propagation of some Diseases by Continuous Succession,	209
Question as to the Spontaneous Origin of Diseases,	211
Nature of <i>Epidemic</i> Influences,	213
<i>Pandemic</i> Oscillations of Disease,	215
Propagation of Typhoid Fever and Cholera,	217

CHAPTER IV.

MANAGEMENT OF EPIDEMICS; AND ON THE PROCEEDINGS WHICH ARE ADVISABLE TO BE TAKEN IN PLACES ATTACKED OR THREATENED BY EPIDEMIC DISEASES,	219
Principles which Guide the Management of Epidemics,	219
Detail of Proceedings,	220
Processes of Disinfection,	224

CHAPTER V.

DETAILED DESCRIPTION OF THE MIASMATIC ORDER OF ZYMOTIC DISEASES,	225
---	------------

SECTION I.—ERUPTIVE FEVERS—*Exanthemata*.

SMALL-POX—<i>Variola</i>,	226
Definition and Pathology of Small-pox,	227
The Formation and Nature of the Small-pox Pustule,	229
Varieties and Symptoms of Small-pox,	231
1. Of Natural Small-pox,	232
Symptoms of Small-pox without Eruption,	232
Symptoms of the Distinct Small-pox,	232
Period of Latency of Small-pox,	232
Range of Temperature in Natural Small-pox,	233
Diagram showing the Typical Range of Temperature in a Case of Natural Small-pox,	234
Symptoms and Phenomena of Confluent Small-pox,	236

CONTENTS.

xxi

	PAGE
2 Of the Inoculated Small-pox,	239
Complications of Small-pox, and Special Morbid Tendencies,	240
Pyogenic Fever after Small-pox,	241
Sequelæ of Small-pox,	241
Pustules on the Mucous Membrane in Cases of Small-pox,	242
3 Of the Small-pox after Vaccination, Varioloid or Modified Small-pox,	244
Symptoms, Cause, and Complications of Modified Small-pox,	244
Typical Range of Temperature in a Case of Modified Small-pox,	245
Exhaustion of Susceptibility to the Future Action of the Poison after an Attack of Small-pox,	245
Co-existence of Small-pox with other Morbid States,	246
Cause of Small-pox,	246
Prognosis and Causes of Death in Small-pox,	248
Unfavourable Signs during the Course of Small-pox,	249
Diagnosis of Small-Pox,	249
Remarkable Epochs in the History and Treatment of Small-pox,	251
(1.) Therapeutic Curative or Sanative Treatment of Small-pox,	252
Dietetic and General Treatment,	252
Means adopted to prevent Pitting,	255
(2.) The Prophylactic, Sanitary, or Preventive Treatment of Small-pox,	256
Inoculation or Artificial Variolation,	257
Cow-pox— <i>Variolæ Vaccinæ</i> ,	258
Definition and Pathology of Cow-pox,	258
Communication of Human Small-pox to Cows,	261
Small-pox and Cow-pox identical in Nature,	263
Vesicular Eruption of Horses as Sources of Variola,	263
Symptoms of Natural Cow-pox,	267
Primary Vaccine Lymph,	268
VACCINATION,	269
Legislative Enactments relative to Vaccination,	271
Nature of the Protection conferred by Vaccination, and the Evidence of its Existence,	273
How the Protective Influence of Vaccination has been Impaired,	279
Re-vaccination advisable from time to time,	281
Protection impaired by imperfect Vaccination,	283
The Operation of Vaccination,	284
Signs of successful Vaccination,	286
Signs of successful Re-vaccination,	287
Characters of the Cicatrix after Vaccination,	288
Means of Estimating the Efficiency of Vaccination,	289
Selection of Lymph for Vaccination,	290
CHICKEN-POX— <i>Varicella</i> ,	292
Definition and Pathology of Chicken-pox,	292
Symptoms and Diagnosis of Chicken-pox,	293
Treatment of Chicken-pox,	294
MILIARY FEVER— <i>Miliaria</i> ,	295
Definition and Pathology of Miliary Fever,	295
Symptoms of Miliary Fever,	295
Treatment of Miliary Fever,	296

MEASLES—<i>Morbilli</i>,	
Definition of Measles,	
Pathology of Measles,	
Diagram representing the Typical Range of Temperature in Measles,	
Symptoms of Measles,	
Characteristics of the Mild Form of Measles,	
Characteristics and Diagnosis of the more Severe Forms of Measles,	
Prognosis in Cases of Measles,	
Sequelæ, Causes, and Propagation of Measles,	
The Treatment of Measles,	
Treatment of the Pulmonary Complications in Measles,	
SCARLET FEVER—<i>Scarlatina</i>,	
Definition of Scarlet Fever,	
Pathology and Symptoms of Scarlet Fever in its Various Forms,	
Uræmic Phenomena and Desquamation in Scarlet Fever,	
Diagram of the Typical Range of Temperature in a Case of Scarlet Fever,	
Dropsy after Scarlet Fever,	
Varieties of Scarlet Fever,	
1. <i>Scarlatina Simplex</i> ,	
2. <i>Scarlatina Anginosa</i> ,	
Dangers in <i>Scarlatina Anginosa</i> ,	
3. <i>Scarlatina Maligna</i> ,	
4. <i>Scarlatina Latens</i> ,	
Sequelæ of Scarlatina,	
Diagnosis of Scarlet Fever,	
Cause and Propagation of Scarlet Fever,	
Prognosis and Treatment of Scarlet Fever,	
Dietetic and Preventive Treatment of Scarlet Fever,	
HYBRID OF MEASLES AND SCARLET FEVER—<i>Rubeola</i>,	
Definition and Pathology of <i>Rubeola</i> ,	
Symptoms of the Hybrid Disease,	
The Eruption in the Hybrid Disease,	
Diagnosis of the Hybrid Disease,	
Table showing the most Prominent Distinguishing Characters of Scarlet Fever, <i>Rubeola</i> , and Measles,	
Prognosis and Treatment of the Hybrid Disease,	
DENGUE—<i>Scarlatina Rheumatica</i>,	
Definition and Pathology of Dengue,	
Symptoms and Treatment of Dengue,	
ERYSIPELAS—<i>Erysipelas</i>,	
Definition and Pathology of Erysipelas,	
Symptoms of Erysipelas,	
Diagnosis of Erysipelas,	
Diagram showing the Typical Ranges of Temperature in a Case of Erysipelas,	
Various Forms of Erysipelas,	
Cause and Propagation of the Disease,	
Period of Latency in Erysipelas,	
Prognosis and Treatment of Erysipelas,	

CONTENTS.

xxiii

	PAGE
THE PLAGUE— <i>Pestis</i> ,	357
Pathology and Historical Notice of the Plague,	357
Symptoms and Phenomena of the Plague,	359
Progress of the Bubo in Plague,	363
Diagnosis and Cause of Plague,	364
Modes of Propagation of the Plague,	365
Communicable Nature of the Plague,	367
Period of Latency of the Plague Poison,	369
Prognosis in Plague,	369
Treatment of the Disease,	370
Preventive Treatment of Plague,	371

SECTION II.—THE CONTINUED FEVERS.

History of the Specific Distinction between Typhus and Typhoid Fever,	373
TYPHOID FEVER— <i>Febris Typhoides</i> ,	378
Definition of Typhoid Fever,	378
Pathology and Symptoms of Typhoid Fever,	379
Symptoms and Phenomena of Typhoid Fever,	381
The Eruption in Typhoid Fever,	381
The Temperature during Typhoid Fever,	383
Typical Ranges of Temperature in Cases of <i>Typhoid</i> and <i>Typhus</i> Fever, contrasted with each other throughout their course,	384
Events which Influence the Course of the Fever,	389
Condition of the Urine in Typhoid Fever,	389
Morbid Anatomy of the Lesions in Typhoid Fever, with special reference to the Phenomena and Progress of the Disease,	392
Enumeration of the Lesions in Typhoid Fever,	393
Anatomical Forms of the Intestinal Glands,	394
Modes by which Elimination of the Gland Lesion occurs,	396
Characters of the Typhoid Ulcers,	399
Lesions in the Mesenteric Glands, Spleen, and Lungs during Typhoid Fever,	401
Deposit of Tubercle during Typhoid Fever,	402
Circumstances under which Death may occur in Cases of Typhoid Fever,	405
Duration of the Attack of Typhoid Fever,	407
Origin and Propagation of Typhoid Fever,	409
Preventive Measures, or Measures for Checking the Spread of Typhoid Fever,	411
Specific Character of Typhoid Fever,	413
Final Practical Indications for the Prevention of Typhoid Fever,	415
Treatment of Enteric or Typhoid Fever,	415
Treatment of the Diarrhœa of Typhoid Fever,	417
Treatment of the Intestinal Affection,	419
Treatment of Hæmorrhages in Typhoid Fever,	421
TYPHUS FEVER— <i>Febris Typhus</i> ,	421
Definition and Nomenclature of Typhus Fever,	423
Historical Notice of Typhus Fever,	424
Phenomena and Symptoms of Typhus Fever,	426

	PAGE
Causes which have produced Disease in the British Army (<i>Foot-note</i>), .	426
The Eruption of Typhus Fever,	428
Range of Temperature in Typhus Fever,	431
Modes in which Typhus Fever may Terminate,	433
Condition of the Blood in Typhus Fever,	434
<i>Secondary Lesions and Complications in Typhus Fever</i> ,	435
1. Convulsions and Cerebral Affections,	435
2. Secondary Pulmonic Complications,	438
3. Gangrene of the Pulmonary Tissue,	439
4. Secondary Cardiac Lesion,	440
Prognosis in Typhus Fever,	440
(1.) Combination of Symptoms and Phenomena which are of extremely Unfavourable Import,	441
(2.) Combination of Symptoms or Phenomena which may be regarded as of Favourable Import,	441
(3.) Modes of Fatal Termination,	442
Morbid Anatomy,	442
Treatment of Typhus Fever,	442
General Indications for Treatment,	444
Special Indications for Treatment,	444
Origin and Propagation of Typhus Fever,	454
RELAPSING FEVER— <i>Febris Recurrens</i> ,	461
Definition and Pathology,	462
Historical Notice of Relapsing Fever,	463
The Primary Paroxysm of Relapsing Fever,	465
Phenomena of the Relapse,	467
Duration of the Fever, and Prolonged Duration of Convalescence,	467
Sequelæ of Relapsing Fever,	470
Treatment of Relapsing Fever,	471
SIMPLE CONTINUED FEVER, OR FEBRICULA— <i>Febris Continua</i> ,	472
Definition of Febricula,	472
Pathology of Febricula,	473
Range of Temperature in Febricula,	473
Range of Temperature in a Case of Protracted Febricula,	474
Necessity for the Accurate Investigation of Fever Cases,	477
Treatment of Febricula,	478
SPECIFIC YELLOW FEVER— <i>Febris Icterodes</i> ,	478
Pathology and Symptoms of Specific Yellow Fever,	479
Professor W. C. Maclean's View of its Pathology,	479
Phenomena of True or Specific Yellow Fever,	481
History of the "Eclair" Epidemic,	482
Symptoms of Specific Yellow Fever,	484
Clinical Phenomena of Specific Yellow Fever,	487
Types, Groups, or Forms of Specific Yellow Fever,	490
Prognosis in Specific Yellow Fever,	492
Treatment of Specific Yellow Fever,	494
SECTION III.—THE LITORAL, MALARIAL, OR PALUDAL FEVERS.	
General Pathology of the Malarious Poison,	500
Persistent Pernicious Effects of Malaria,	502

CONTENTS.

XXV

	PAGE
Morbid Appearances in Malarious Yellow Fever,	505
Opinions as to the Nature of Yellow Fever,	506
Causes and Modes of Propagation of Malarious Fever,	509
Nature of Malarious Soils,	511
Predisposing Causes of Malarious Fever,	513
INTERMITTENT PALUDAL FEVER OR AGUE—<i>Febris Intermittens</i>,	515
Definition of Intermittent Fever,	515
Symptoms of Intermittent Fever,	515
Phenomena of a Paroxysm of Ague,	516
Range of Temperature in <i>Quotidian</i> Ague,	519
Range of Temperature in <i>Tertian</i> Ague,	520
Range of Temperature in <i>Quartan</i> Ague,	521
Condition of the Urine in Ague,	522
Treatment of Ague,	523
REMITTENT PALUDAL FEVER—<i>Febris Remittens</i>,	527
Definition and Symptoms of Remittent Fever,	527
Treatment of Remittent Fever,	531
Professor W. C. Maclean's Treatment of Remittent Fever,	535
Relative Mortality of Remittent Fever at the Foreign Stations of the British Army,	538
MALARIOUS YELLOW FEVER—<i>Febris Icterodes Remittens</i>,	538
Definition and Pathology of Malarious Yellow Fever,	538
Conditions Favourable to the Development of Malarious Yellow Fever,	539
Nature of the Soil in Malarious Districts,	541

SECTION IV.—MUCOUS FEVERS.

INFLUENZA—<i>Influenza</i>,	543
Definition and Historical Notice of Influenza,	543
Pathology of Influenza,	544
Symptoms, Course, and Complications of Influenza,	545
Causes and Modes of Propagation of Influenza,	548
Prognosis and Treatment of Influenza,	549
WHOOPING-COUGH—<i>Pertussis</i>,	551
Definition, Pathology, and Morbid Anatomy of Whooping-cough,	551
Symptoms of Whooping-cough,	554
Complications of Whooping-cough,	557
Causes and Modes of Propagation of Whooping-cough,	558
Period of Latency and Prognosis of Whooping-cough,	560
Treatment of Whooping-cough,	560
DIPHTHERIA—<i>Diphtheria</i>,	565
Definition and Historical Notice of Diphtheria,	565
Pathology and Morbid Anatomy of Diphtheria,	565
Condition of the Urine in Diphtheria,	567
Phenomena and Symptoms of Diphtheria,	569
Varieties or Forms of Diphtheria,	570
Prognosis and Sequelæ of Diphtheria,	572
Propagation of Diphtheria,	573
Treatment of Diphtheria,	573

	PAGE
CROUP—<i>Cynanche Trachealis</i>,	575
Pathology and History of Croup,	575
Phenomena of Croup,	577
Symptoms and Course of Croup,	581
Diagnosis, Modes of Propagation, and Prognosis of Croup,	582
Treatment of Croup,	583
Question of Tracheotomy in Croup,	584
DYSENTERY—<i>Dysenteria</i>,	587
Definition of Dysentery,	587
Historical Notice of Dysentery—Its Pathology and Morbid Anatomy,	587
Prevalence and Mortality of Dysentery in Various Countries,	588
Various Forms of Dysentery,	589
Acute Cases of Dysentery,	590
Chronic Cases of Dysentery,	590
Complex Cases of Dysentery,	590
Anatomy of the Morbid Tissues in Acute Dysentery,	591
Various Opinions as to the Nature of the Anatomical Lesions in Dysentery,	593
Question relative to the Solitary Gland Lesion,	595
Morbid Anatomy of Dysentery,	597
Dr. Baly's Description of Dysentery,	599
Examination of the Evacuations in Dysentery,	600
Vascularity of the Dysenteric Lesions,	601
Morbid Anatomy of the Lesions in Chronic Dysentery,	603
Anatomy of the Morbid Tissues in Complex Cases of Dysentery,	604
Atrophy of the Mucous Membrane in Dysentery,	605
Hepatic Complication in Dysentery,	607
Pulmonary Lesion in Dysentery,	609
Types and Forms of Dysentery,	611
Symptoms of Dysentery,	612
Causes and Propagation of Dysentery,	613
Effects of a Salt Diet in Favouring the Development of Dysentery,	615
Prognosis, Diagnosis, and Treatment of Dysentery,	617
Dr. W. C. Maclean on the Treatment of Dysentery,	621
DIARRHŒA—<i>Diarrhœa</i>,	622
Definition and Pathology of Diarrhœa,	622
Symptoms and Forms of Diarrhœa,	622
1. Diarrhœa of Irritation,	623
2. Diarrhœa from Increased Vascular Action,	623
3. Diarrhœa with the Discharge of Unaltered Ingesta,	624
Treatment of Diarrhœa,	624
CHOLERA—<i>Cholera</i>,	626
Definition of Cholera,	626
Pathology of Cholera,	627
Rapidly Fatal Nature of the Cholera Poison,	629
Post-mortem Appearances in Cholera,	631
Relation of Blood Changes to Bowel Discharges,	633
Symptoms and Various Forms of Cholera,	635
Three Principal Varieties of Cholera,	635
The Cold Stage of Cholera,	637

CONTENTS.

xxvii

	PAGE
Re-action and Typhoid Phenomena in Cholera,	639
Origin and Modes of Propagation of Cholera,	640
Origin of the Cholera Poison,	641
Meteorological Conditions favourable to the Development of Cholera,	643
Localizing Causes of Cholera,	645
Conditions which favour the Spread of Cholera,	647
Propagation of Cholera by Human Intercourse,	648
Predisposing Causes of Cholera,	652
Susceptibility to Cholera,	654
Diagnosis and Prognosis in Cholera,	655
Treatment of Cholera,	656
Dr. W. C. Maclean on the Treatment of Cholera,	657

CHAPTER VI.

PATHOLOGY OF THE ENTHETIC ORDER OF ZYMOTIC DISEASES.

Specific Effects of Morbid Poisons,	661
Specific Character of Enthetic Diseases,	663

CHAPTER VII.

DETAILED DESCRIPTION OF THE ENTHETIC ORDER OF ZYMOTIC DISEASES.

HYDROPHOBIA—<i>Rabies</i>,	665
Definition of Hydrophobia,	665
Pathology and Symptoms of Hydrophobia,	665
<i>Post-mortem</i> Appearances in Hydrophobia,	669
Phenomena of Hydrophobia in the Dog,	673
Diagnosis of Hydrophobia,	675
Prognosis and Treatment of Hydrophobia,	676
Preventive Treatment after Hydrophobic Inoculation,	678
GLANDERS AND FARCY—<i>Equinia</i>,	679
Definition and Pathology of Glanders,	679
Symptoms of Glanders,	682
Cause of Glanders,	683
Inoculation of Glanders,	685
Period of Latency of Glanders,	686
Diagnosis of Glanders,	686
Treatment and Preventive Treatment of Glanders,	687
MALIGNANT PUSTULE (VESICLE?)—<i>Pustula Maligna</i>,	687
Definition of Malignant Pustule,	687
Pathology and Historical Notice of Malignant Pustule,	688
Propagation of the Disease,	689
Phenomena and Symptoms of the Malignant Vesicle,	690
Treatment of Malignant Pustule,	691
SYPHILIS—<i>Syphilis</i>,	691
Definition of Syphilis,	691
Pathology and Morbid Anatomy of Syphilis,	692
Prevalence of Syphilis in the Army,	695

	PAGE
Nature of the Syphilitic Poison,	695
Characters of Venereal Sores,	696
Historical Identification of Venereal Sores,	696
I. The Period and Doctrine of Hunter—the <i>Hunterian Chancre</i> ,	696
II. The Period and Doctrine of Ricord,	697
III. The present Period in the History of Syphilis,	698
Incubation of Syphilis,	699
Question as to Second Attacks of Syphilis,	701
Nature of the "Infecting Sore,"	703
Nomenclature to be attended to in the Description of Venereal Sores,	703
Vehicles or Media by which the Specific "Infecting" Virus may be Inoculated,	704
Hints for the Investigation and Description of Syphilitic Ulcers,	705
Nature and History of the Doctrine of Syphilization,	706
Process or Operation of Syphilization,	708
Secondary Lesions and Morbid Anatomy of Syphilis,	709
The <i>Gummata</i> of Syphilitic Lesions,	711
Development and Course of the Syphilitic Node,	712
Syphilitic Lesions in the Bones,	713
Syphilitic Lesions in the Skin,	713
Syphilitic Affections of the Nails,	714
Syphilitic Lesions of the Heart,	714
Syphilitic Lesions of the Brain,	715
Syphilitic Lesions of the Lungs,	717
Syphilitic Lesions of the Testicles,	718
Syphilitic Lesions of the Tongue,	718
Treatment of Syphilis,	718
Mercury in the Cure of Syphilis,	719
Non-mercurial Treatment of Syphilis,	721
Local Treatment of Syphilitic Lesions,	723
Iodide of Potassium in Syphilis,	723
Vapour or Hot Air Bath in Syphilis,	724

CHAPTER VIII.

ON THE NATURE OF ACUTE SPECIFIC OR GENERAL DISEASES.

Specific Characters of these Diseases,	725
Causes of these Specific Diseases,	726
Defined Periods of Incubation,	727
Defined Periods of Development,	727
Defined Periods of Defervescence and Convalescence,	727

THE
SCIENCE AND PRACTICE OF MEDICINE.

PART I.
TOPICS RELATIVE TO PATHOLOGY.

CHAPTER I.

OF MEDICINE AS A SCIENCE AND AS AN ART; ITS OBJECTS
AND ITS EXTENT.

THE study of MEDICINE is prosecuted under two relations, namely, as a *Science* and as an *Art*. MEDICINE, considered as a *Science*, takes cognizance of all that relates to our knowledge of diseases; and, especially, of the circumstances under which they become developed, of the conditions of their existence, of their nature and of their causes in the widest sense of these terms. Considered as an *Art* (in so far as Medicine has that practical value), its object is to distinguish, to prevent, and to cure diseases.

The object and aim of MEDICINE as an *Art* is to alleviate human suffering, and to lengthen out human existence, by warding off or by modifying disease "as the greatest of mortal evils," and by restoring health, and even at times reason itself, "as the greatest of mortal blessings." In other words, the practical view required to be taken of MEDICINE is, that "it is the art of understanding the nature of diseases, so as to appreciate their causes, and to prevent their occurrence when possible; to promote their cure, or to relieve them when they occur." (BIGLOW.)

Many branches of human knowledge are combined in the constitution and elucidation of the *Science*; and the practice of

Medicine as an *Art* ought to be founded on principles and facts of universal, or at least of extensive applicability.

A consideration of the different topics which together make up the Science of Medicine suggests a division of the subject into the following departments, namely:—(1.) **PHYSIOLOGY**, which embraces the study of the healthy functions of which the human body is the seat or instrument; (2.) **PATHOLOGY**, subdivided into *Special Pathology* and *General Pathology*, which together embrace a consideration of everything relative to the existence and nature of disease—(Special Pathology being intended to comprehend a consideration of the essential nature and origin of particular diseases as they occur in man and animals, and General Pathology to include those more general facts or principles which result from a comparison of particular diseases with each other); (3.) **THERAPEUTICS**, which expounds the various actions of remedies upon the diseased economy, or the means by which Nature may be aided in her return to health; (4.) **HYGIENE**, which embraces a consideration of the means of preventing disease, or, in other words, of preserving health.

Physiology, General Pathology, Therapeutics, and Hygiène are sometimes designated indifferently by the titles of the "*Institutes*," the "*Institutions*," or the "*Theory of Medicine*."

These departments of science are all preliminary subjects of study, and constitute a necessary and appropriate introduction to the Practice of Physic, in which Special Pathology and the treatment of special diseases are the leading topics of consideration.

Each of these departments has grown or expanded itself into a great branch of science, and any single section is sufficient of itself to occupy the lifetime of an individual in working out and studying it in detail. It is, therefore, not possible for the human mind to embrace all of these departments in their whole extent, and their bearings or relations to each other; and, setting aside the consideration of theories and systems, it has been truly observed, "that no man possesses all the pathological knowledge contained in the records of his art" (CHOMEL); and it is, therefore, far less possible to embrace in any single treatise a view of the science of Medicine in all of these departments.

For the purpose of teaching the science of Medicine in its application to practice, its elementary principles, as developed in

the departments of Pathology, are the most useful guides to the student.

Although Special Pathology comes first in the order of Nature, yet, wherever the arrangements for Medical education are complete, General Pathology is taught as an introduction to, or conjointly with, the special study of diseases, just as in other sciences—for example, in chemistry—it is found convenient to give a general view of the principles which have been established by experiment and observation before entering upon the particular details of the science.

It is intended, however, in the first part of this handbook merely to guide the student to notice,—(1.) How the nature of diseases may be elucidated; (2.) The *relative* nature of the terms "*Life*," "*Health*," "*Disease*;" (3.) The nature of the morbid phenomena, symptoms, and signs of disease; (4.) The means and instruments of investigation into the nature and causes of disease; (5.) Some of the more elementary constituents of disease; (6.) Some complex morbid states associated with individual diseases, or with conditions of ill health (*cachexiæ*); (7.) The modes by which diseases terminate fatally; the types of disease and their tendency to change; (8.) The general treatment of the complex morbid processes.

In the three subsequent parts of this work it is intended to consider some of the details of the science and practice of Medicine, to furnish the student with,—(1.) A nosological system, by which to classify and name diseases. (2.) A detailed description of characteristic diseases in the respective classes of that nosological arrangement. In this part a definition and a history of the nature of each disease will be given; the probable course and succession of events will be described, and the grounds on which an accurate diagnosis may be made, or a prognosis expected; and, lastly, a detailed account of those rational modes of treatment which are consistent with the established principles of the *Institutes of Medicine*. (3.) An account of what is known relative to the geographical distribution of diseases.

CHAPTER II.

HOW THE NATURE AND CAUSES OF DISEASES MAY BE
ELUCIDATED.

THE nature of the derangements to which the human body is liable may be studied under the three following aspects:—(1.) As diseases present themselves in individual cases, becoming thereby the subjects of **CLINICAL INSTRUCTION**; (2.) As they constitute particular genera or species of disease, forming the topics of **SPECIAL PATHOLOGY**; (3.) As they may be reduced to and studied in their primary elements, forming thereby the science of **GENERAL PATHOLOGY**.

But, in whatever aspect we may view disease, there is invariably presented to the student the same subjects for investigation, namely,—*First*, The morbid phenomena or symptoms by which we become aware that derangements have taken place in the economy. It is by a mental effort that either the student or the physician converts these symptoms into signs of disease; and hence arises the necessity of studying *Symptomatology*, or *Semeiology*. *Second*, The agents by which derangements and diseases are produced, generated, or brought about, constituting the department of *Etiology*. *Third*, The seats or localities of disease, or of derangements, constituting *Pathogeny*. Here the peculiar nature, general forms, and types of disease must be studied, together with varieties in their course, duration, and termination. *Fourth*, The morbid alterations discoverable in the structure of the body before, but more especially after death, constituting *Morbid Anatomy*. These alterations must be studied in connection with the symptoms, the causes, and the course of the disease. *Lastly*, The elementary constituents of diseased products, constituting *Morbid Histology*, must be recognized in the first instance, and contrasted with analogous constituents of the body in the healthy state.

CHAPTER III.

RELATIVE NATURE OF THE TERMS *LIFE, HEALTH, DISEASE.*

THE word *Disease* is used in a general and also in a specific sense; as when it is said that a person is diseased, without the nature of the affection being stated; or, that he suffers from a particular disease, such as small-pox. Attempts to give a precise definition of the term *Disease* have all been unsuccessful. The relations of the morbid state to the condition of health, and of health to the performance of the vital functions, are of such a kind that they can merely be described in connection with each other, but not defined.

If *life* is understood to imply an active state, resulting from the concurrent exercise of the functions of the body, then there are conditions of activity and of mutual adaptability of functions and of parts, both as regards body and mind, which are necessary to healthy existence.

Our notions of *the conditions of health* have thus considerable latitude. *Health* is merely a name we give to that state or condition in which a person exists fully able, without suffering, to perform all the duties of life. Many degrees of this state are therefore at first sight obvious, from the possession of a feeble existence to the most robust condition of the body; and there are many degrees of feebleness and delicacy of health which we cannot say are due either to disordered or diseased states of the frame.

Our notions of *normal life* are so extremely indefinite that it is only by a forced abstraction the normal can be separated from the abnormal. Hence also our idea of *disease* is very indefinite; it cannot be separated by any well-defined boundary from our idea of *normal life*, and the two conditions are connected by a kind of debatable border land.

When we regard, therefore, the phenomena of the living state and the conditions of health, we can readily observe when and how *disease* is but A DEVIATION FROM THE STATE OF HEALTH, CONSISTING FOR THE MOST PART IN A CHANGE IN THE PROPERTIES OR STRUCTURE OF ANY TISSUE OR ORGAN, WHICH RENDERS

SUCH TISSUE OR ORGAN UNFIT FOR THE PERFORMANCE OF ITS ACTIONS OR FUNCTIONS ACCORDING TO THE LAWS OF THE HEALTHY FRAME.

It is now a received pathological doctrine that *disease* does not consist in any single state or special existence, but is the natural expression of a combination of phenomena, arising out of impaired function or altered structure.

All attempts, therefore, to define disease by the use of such terms as "*derangement*," "*modification*," "*alteration*," "*change*," from the pre-existent state of health, show, in the first instance, that very various ideas are attached to the term or to the state; and, secondly, that these terms point to a nosological division into structural and functional disease, rather than to a state common to all forms of disease.

A definition of any state of disease ought to include all the circumstances, whether functional or organic, which constitute the deviation from health; and for very obvious reasons such a definition can only be approximatively expressed.

CHAPTER IV.

OF MORBID PHENOMENA, SYMPTOMS, AND SIGNS OF DISEASE.

It has been stated that only by a mental effort is the student or physician able to convert *symptoms* into *signs* of disease. Therefore, the idea associated with "*sign*" is of a much more comprehensive kind than that which is connected with the word "*symptom*:" the former implies the possession of more extensive knowledge—a knowledge such that comparisons may be instituted amongst the symptoms which present themselves. Certain symptoms of disease or of disordered function are thus recognized to be peculiar, characteristic, or *significant* of a particular morbid state. A symptom is thus converted into a sign, and what is called a *diagnosis* of the disease is made.

Symptoms and signs of disease derive their importance from the fact that they are capable of being connected with lesions of structure or disorders of function; and both of these conditions

mutually act and re-act upon each other, and thus they greatly aggravate the expression of general disease. In place of the concurrent exercise of function and the mutual co-operation of parts in a state of health, both as regards mind and body, we have *symptoms* of disease expressed in various ways, characteristic of the function at fault, and incompatible with the normal existence of the part or organ affected, or of the body generally. From such phenomena the physician makes up his mind,—(1.) As to whether or not disease exists; (2.) How far the condition of the patient is removed from the state of health usual to him; (3.) As to the nature of the disease, and how it is distinguished from other ailments, or in what respects it may differ from the same ailment in other people in similar circumstances. Thus a *diagnosis* is made by the art of converting *symptoms* into *signs* of disease.

But the physician at the same time generally carries his mental exertion a little further. He tries to arrive at a just estimate of the probable result or *event* of the malady, and so makes up his mind,—(4.) As to whether the illness will terminate in the death of the patient, in permanent organic mischief of greater or less extent, in persistent impairment of the general health (*cachexiæ*), or in complete recovery. As in Politics, so in the science of Medicine: the politician and the physician have each to deal with the future, as well as with the present. Both endeavour to *forecast* events; and thus, in the practice of Medicine, we are said to make or give a *prognosis*. (5.) The physician must be able also to appreciate with reasonable rapidity those *symptoms* which are peculiar, and to recognize them when associated together as the *signs* of particular or definite morbid states. Such *symptoms* are then said to furnish *pathognomonic signs* of disease. (6.) The physician must further discriminate, and try to put a fair and just value or interpretation upon those symptoms which are only experienced by the sensations (subjective) of the patient himself, as contrasted with those which may be seen or appreciated by others—such as objective phenomena or physical signs.

The interpretation of symptoms can only be successful after a close observation of the patient—often prolonged, and repeated for more complete investigation—so as to connect the results arrived at with his previous history. The utmost logical acumen is required for the due interpretation of symptoms.

The individual value of every symptom ought to be duly weighed; one symptom must be compared with another, and each with all; while the liability to variation of a similar symptom in different cases of a like kind must not be forgotten, while the occasional absence of the usual pathognomonic signs may also be sometimes calculated upon. Thus only can the nature of a disease be clearly determined—its severity and dangers fully appreciated—its treatment indicated, and the probability of recovery foretold.

A close observation of general symptoms, in all their details, is absolutely necessary; and the investigation is aided practically by improved instruments and methods of examination. Above all things, *methodical examination* is essential for the student, if he would acquire the habit of carefully and accurately examining the nature of the cases of disease with which he will have to deal. Patients must be examined methodically, in order that the symptoms of disease may be correctly interpreted, and that nothing be overlooked or neglected. Directions have been given by many authorities for acquiring and habitually following a definite system of examining patients, as to what are the essential data to be obtained and recorded in case-taking; and although, as Dr. Acland justly remarks, a skilful practitioner can learn the truth of most cases in any order, or in no order, yet it is highly desirable that a regular order should be followed by learners; and the case should be methodically entered in a note-book for the purpose.

The following works are recommended for study, and as guides for acquiring the best methods of observing and recording cases:—(1.) *A Manual of Medical Diagnosis*, by A. W. Barclay, M.D.; (2.) *A Handbook of Hospital Practice; or, an Introduction to the Practical Study of Medicine at the Bedside*, by Robert D. Lyons, M.B., Professor of Medicine in the Catholic University of Ireland; (3.) *An Introduction to Clinical Medicine*, by John Hughes Bennett, M.D., senior Professor of Clinical Medicine in the University of Edinburgh; (4.) "Suggestions for taking Cases," by Dr. Beale, *Archives of Medicine*, vol. iii., p. 47.

CHAPTER V.

MORBID ANATOMY AND PATHOLOGICAL HISTOLOGY: THE SPECIAL MEANS AND INSTRUMENTS BY WHICH THE NATURE OF DISEASES MAY BE INVESTIGATED.

MORBID or, as it is also sometimes called, PATHOLOGICAL ANATOMY is that department of medical science which treats of the changes produced by disease in the solids and fluids of the body; while MORBID or PATHOLOGICAL HISTOLOGY treats of the origin, development, growth, and decay of the new products or new formations which are the elementary constituents of structural or organic lesions. The anatomy of diseased parts stands in the same relation to the development of morbid phenomena and conditions of disease that the anatomy of healthy structures and the histology of the textures do to the natural functions and process of development, growth, and nutrition in the healthy body.

The vestiges left by the prolonged existence of a morbid state, whether in the body of man or of the lower animals, have always claimed from the physician a large share of attention; and in proportion as the knowledge of healthy anatomy and physiology has become extended and prosecuted in all its bearings, so has pathological science been extended, and morbid anatomy has gradually but steadily acquired an important and prominent position among those branches of study on which medicine rests its claims as a science.

MORBID ANATOMY is a department of medical science which has gradually grown out of the accumulated experience and observation of ages; but PATHOLOGICAL HISTOLOGY, as a science, is of modern origin. It is but yet in process of development, although its foundations may be traced in the works of the earliest medical writers of antiquity. All of them refer to changes which they *merely supposed* had taken place in the internal organs; and they were doubtless led to this assumption by observing the connection that existed between structural lesions of the external parts and their accompanying symptoms. Hippocrates describes the deposit of tubercles in the lungs, the symptoms occasioned by them in a crude state, and those which attend their softening and discharge.

The science of MORBID ANATOMY is a record of facts. In its relation to the progress of medicine it is a living record—a history whose pages must be ever open to receive the observations which are constantly being made by those engaged in pathological pursuits—a record from which one may ascertain at any time the conditions under which morbid changes or new formations in the body have taken place. The pages of this history show that at the present day the department of pathology is in a transition state; and the position of medicine, as a science, must eventually result from a re-arrangement of the innumerable details which the sciences of morbid anatomy and histology may disclose and unfold. It is necessary, therefore, and often advantageous, to look back upon the past, and see what has already been done, so that its venerable facts may not be lost sight of, but grouped in series with the extensively verified experiments and observations of the present day. In so doing, if we pause and contemplate the steps which have been taken to arrive at our present position, such a contemplation may stimulate the youthful student to the noblest exertions of his intellect, as he cannot fail, with extensive study, to see before him, and on every side, much unlaboured but productive soil. Such a retrospect will at the same time have the effect of placing in a prominent aspect the varied influences which morbid anatomy has had on the science of medicine, the conditions under which it has flourished, and the legitimate objects of its investigations.

The art of printing had not been long invented when books on morbid anatomy began to issue from the press; and although the early period of the fifteenth century has left little enduring literature of any kind (but has been mainly distinguished by the number of colleges then founded), yet about this time pathological anatomy in the medical school of Florence shows the earliest traces of existence.

The facilities for study which the art of printing introduced soon stirred up ardent students; and the sixteenth and seventeenth centuries produced much that will ever remain famous in the annals of medical science. Eustachius, Tulpius, Ruysch, Harvey, Malpighii, and Leuwenhoeck are names familiar as household words to the student of medicine. The earlier attempts of this period to form a system of pathological anatomy

is characterized by abortive endeavours to explain all results upon some exclusive and general principle. A spirit of speculation marks the character of the age. The men of that time had observed but few facts; and on these facts they preferred to speculate and dogmatize, rather than prosecute the further interpretation of nature, or record more observations. Accordingly, theories in abundance successively led captive the minds of the medical world, and, disappearing one after the other, demonstrated the unstable nature on which the science of medicine had been placed. The leader of each sect founded his so-called school or system, all of them distinguished by a due amount of arrogance and contempt for predecessors and contemporaries—a feeling unhappily not yet quite extinct. The “*vital agency*,” the “*influence of the humors*,” and of the “*solid organs*,” have each been considered by turns as the only orthodox belief; and each has had their school and sect respectively designated as the *Vitalists*, the *Humoralists*, and the *Solidists*. The theories of Galen, of Paracelsus, and others, have all been famous in their time, but are now unheard of, and almost unknown. The same fate awaits the false theories and absurd conceits of more recent origin, although, as in the case of Stahl, Cullen, Brown, and Broussais, they have had a wide prevalence in the schools of Europe, and made impressions on the sentiments of the profession which yet influence their modes of practice and the reasons of their belief. *Broussaisism*, *Hahnemannism*, and some other systems, “the fruits of a luxuriant fancy and of few facts,” must all descend, as others have done, the same inevitable slope to oblivion; but the vast collection of facts which the founders and followers of such systems eventually accumulate and bring to notice, remain unchangeable, and will continue to recur in the daily experience of our profession, just as they appeared to the venerable fathers of medicine centuries before the Christian era. The practice of medicine, as based upon rational principles and a knowledge of the nature of diseases, has oscillated through all these systems and theories, and the science of morbid anatomy has been marked throughout by unmistakable periods of *progress*, of *stationary existence*, or even of *retrogression*, according as one or other exclusive system had the ascendancy, or as each principle of practice challenged for itself a supreme importance.

The modern doctrines relative to the nature of diseases and the

practice of medicine may be said to be guided by the dictates of *Physiology*, and what is known regarding the development of the human body. Ordinary dissections alone, or *post-mortem* examinations of the body, have long since ceased to furnish us with facts before unknown; and new modes of extending observation and research, by taking advantage of every physical aid to the senses, are diligently looked for by the modern anatomist, physiologist, and physician; and the means and instruments which advance the science of physiology are well able to advance our knowledge regarding the nature of disease-processes.

A belief is now rapidly gaining ground, and acquiring a hold on the popular mind, that advances in the science of medicine in future years will be mainly due to a *better appreciation of the causes of disease*; and just in proportion as our knowledge of physiology and pathology becomes more exact and extended, so will the *causes of disease* be appreciated, and the *occurrence of disease* on a large scale prevented. An amiable and large-minded physician, Sir John Forbes, who but recently has taken his place amongst the "Great Ones of the Past," emphatically recorded the observation more than fifteen years ago, that "here the surest and most glorious triumphs of medical science are achieving, and are to be achieved." He himself lived to see great and good results; to see improvements in social and sanitary matters which continue to be realized, and whose rapid progress is characteristic of the present period. Within the last half-century land-draining and town-sewering have ripened into sciences. From rude beginnings, insignificant in extent, and often injurious in the first instance, the systematic sewerage of towns and draining of land have become of the first importance. Land has thus, in not a few instances, doubled its value. Town-sewering, with other social regulations, have contributed to prolong human life from 5 to 50 per cent. as compared with previous rates in the same district. Agues and typhoid fevers are reduced in the frequency of their occurrence. Since 1840 an annual mortality in English towns of 44 in 1,000 has been reduced to 27; an annual mortality of 30 has been reduced to 20, and even as low as 15. Not less remarkable reductions have taken place in the mortality and loss of strength in the army and navy; so that generally it may be said that human life has now more value in England than in any other country in the world—a result entirely due to better sanitary

arrangements. (Rawlinson "On Sewering of Towns," *Soc. of Arts Journal*, vol. x., p. 276.)

The political economist cannot now, therefore, regard MEDICINE in any other light than as a productive art; and the labours of the physician, whether in civil or in military life, cannot be regarded as unproductive labour.

But the science of Physiology (on which much of our sanitary improvements are based) has immeasurably outstripped the science of Pathology in the comprehensiveness of its views and in the value of its results; while Pathology, in its turn again, has always been, and ought to be, in advance of Therapeutics. It is in the very nature of pathology to be always in advance of the treatment of diseases; for pathological knowledge is the basis of rational medicine, it being rational to know the nature of a disease in order,—(1.) To enable the physician to prevent it; and, (2.) To enable him to understand the principles which ought to guide him in its treatment to a successful issue. The best physiologists have distinctly recognized that the basis of their science must include not only a knowledge of animals below man, but a knowledge of the entire vegetable kingdom. Without such an extensive survey of the whole realm of organic nature, we cannot possibly understand human physiology, and far less comparative physiology. The science of Pathology, therefore (whose aim is to expound the *nature of diseases*), must be, *à fortiori*, very far behind. The diseases of the lower animals, for instance, rarely form any part of the study of the student of medicine. The diseases of plants are almost entirely neglected. Yet it is clear that until all these have been studied, and some steps taken to generalize these results, every conclusion in pathology regarding the nature of diseases must be the result of a limited experience from a limited field of observation. How do we know that the blights of plants, or the causes of them, are not communicable to animals and to man? We know how intimately related the diseases of man and animals are with famines and unwholesome food; and of famines with the diseases of vegetable and animal life, as much as with the destruction and loss of food. (See chapters on Zymotic diseases.)

To physiology, therefore, in its most comprehensive sense, and to a knowledge of the natural and normal development of animal and vegetable beings, we must look for future progress in

pathology; while the means and the instruments which advance physiology will simultaneously advance our knowledge regarding the *nature of diseases*,—a sound knowledge of which can alone enable us to “*appreciate their causes*,” and so arrange measures for the *prevention of many of them*, based on the great truths of science.

Organic chemistry, the microscope, the ophthalmoscope, and such-like instruments, have opened up new fields of labour, which are being diligently cultivated; and while alterations in the ultimate tissues and organs are more especially attended to, the first beginnings of disease, and the development of new formations, and examination of excretions, claim a large share of attention.

Histology, or the study of the development and arrangement of the tissues in the formation of normal and healthy organs, is characteristic of the anatomical investigations of the present day; while the histology of morbid products and chemico-physiological investigation into the nature of morbid changes is characteristic of the pursuits of the science of modern PATHOLOGICAL ANATOMY.

It is also a significant fact that now, in the nineteenth century, some of the leading doctrines of the *humoral* pathology which prevailed in the seventeenth are again revived. The experience and learning of that erudite period are now being made available for modern uses. By the improved means, instruments, and methods of research of modern times, important truths may be sifted from the errors and theories with which they are mixed up in the ancient chronicles of medical science; and when we get analogous conditions of disease with which the phenomena described by the ancients may be compared, “not a few of the apparently modern beliefs are daily found to have a time-honoured reputation unappreciated before.”

The chemist and the histologist now combine their researches, and work hand in hand; and we regard them as the most inquisitive anatomists of the time. They lend assistance of the most important kind in working out the foundation of our knowledge regarding the nature of diseases, the details of which can only be made more certain and perfect by taking advantage of every kind of scientific knowledge which can be brought to bear upon medical research, and more especially,—(1.) By physical aids to the senses, extending our means for the actual inspection and appreciation of phenomena. The use of the stethoscope, of the microscope, ther-

mometer, ophthalmoscope, laryngoscope, and specula of various kinds, aided by a careful study of the writings and labours of the men who have more particularly devoted their attention to observations by such means, may be quoted as examples (LAENNEC, LOUIS, WALSHE, STOKES, HOPE, BENNETT, QUECKETT, VIRCHOW, WUNDERLICH, TRAUBE, VOGEL, BEALE, GRAEFE, CZERMAK and others). (2.) By the knowledge (gradually being made more extensive) of the textures, organs, and functions of the body, whose normal exercise constitutes a healthy existence (LONGET, MULLER, SHARPEY, VALENTIN, ALLEN THOMSON, CARPENTER, KIRKES, PAGET, KÖLLIKER). (3.) By an intimate knowledge of the normal development of the human textures, as well as those of plants and animals from the fecundated ovum (BISCHOFF, COSTA, ALLEN THOMSON, HUXLEY, NEWPORT, and KÖLLIKER). (4.) Besides these kinds of investigations, the science of practical medicine has been, and is being, advanced by operations and experiments upon the internal organs of living animals, opprobriously termed *vivisections*. At some of our great schools of medicine such investigations are now being actively but judiciously prosecuted and taught; as by Bernard in Paris, Drs. G. Harley, Brown Sequard, and Pavy in London.

Successful inquiries into the nature of diseases cannot be said to have commenced till the middle of the eighteenth century, when the great work of Morgagni issued from the press. It was the work of his lifetime. In the eightieth year of his age, and not till then, did he consider himself warranted to publish his observations, *De Sedibus et Causis Morborum* (1761); a work whose material and circumstances of publication read us the practical lesson, that the more frequently a disease occurs, the more necessary it is that its phenomena should be carefully investigated. And when we observe, also, the prudent reserve, the anxious and the conscientious delay exhibited by Harvey, Morgagni, and Jenner, in the publication of their respective researches, we cannot but contrast the circumstances with those under which the exuberance of medical publications are now given to the world. Morgagni modified and corrected many of the views entertained and promulgated by his predecessors; and the study of the nature of diseases was carried into the commencement of the present century by CULLEN, WILLIAM and JOHN HUNTER, PORTAL, and BICHAT.

The knowledge of the physician regarding the nature of disease-

processes may now be observed to have advanced simultaneously with that of *general anatomy*; and when the component parts of an organ, and of the human body, came to be distinguished, it was soon observed, also, that membranes and tissues might be individually diseased while neighbouring membranes and tissues remained untouched. Bichat's idea, therefore, of decomposing the animal body into its elementary parts, must be regarded as the foundation of modern special pathology; and while he pointed out the necessity of studying diseases with reference to the different tissues as separately and specially affected, it has been since shown, in a remarkable manner, how general anatomy, deduced from physical properties of parts and crude observation, may coincide with more minute investigations of a chemical and microscopical kind. The membranes and tissues composing the organs of the body, roughly torn asunder by Bichat, are now themselves being daily subjected to a more inquisitive analysis of an anatomical and chemical nature, which unravels them into still more minute histological elements.

Although, therefore, Bichat entertained the view that each tissue had its own *diathesis*, it is to Cullen and the Hunters in this country more especially that the application of the distinction of tissues was made to illustrate the nature of disease-processes.

Cullen's descriptions of diseases are descriptions of groups of phenomena which comprise complex morbid states.

The written labours of the Hunters form but a small part of the memorials of what they did to elucidate the nature of diseases, and it is only those who have had the opportunity of carefully examining their museums, preserved in London and in Glasgow, that are able to form any conception of the comprehensive nature of their labours, or to assign to them a proper place among those who have successfully advanced the science of Medicine. They hold a position at least one hundred years in advance of the age in which they lived. Bichat, Cullen, and the Hunters, in their respective countries, have thus reciprocally influenced and advanced the progress of our knowledge regarding the nature of diseases. And although it was reserved for Bichat to complete a more perfect system of general anatomy, it must not be forgotten that Dr. Carmichael Smith, in 1790, applied his knowledge of textural anatomy to elucidate the nature of disease-processes; and that Pinel, after him, in his *Nosographie Philosophique*, made the dis-

inction between the membranous and other animal structures the foundation of his pathology. The classic work of Baillie (his *Morbid Anatomy*), published in 1793, closed the labours of the past century.

If now we look to the tendency of the studies and researches of those men we have just mentioned, including Bichat, we shall find the truth gradually being more fully appreciated, that it was necessary to study alterations of structure so as to connect morbid changes with the symptoms of diseases during life, and with the operations of ascertained causes of morbid action. The nature of the morbid changes were now also observed to be more apparent in the progress of external diseases; and therefore surgical experience was brought to bear upon the elucidation of internal disease-processes.

Thus the progress of morbid anatomy is, in a great measure, a record of the history of Medicine; and we can trace the science of special morbid anatomy, giving a character to the various systems of the healing art which have prevailed from time to time.

All the writers up to the time of Bichat, Laennec, and Abercrombie were pure morbid anatomists, who did not connect the effects of disease with their causes, and who recognized the changes of disease as important only in proportion to their magnitude as apparent to the senses. They are therefore regarded as pure solidists, whose researches doubtless contributed much towards a correct knowledge of the changes in the organs of the body, while the condition of the fluids was neglected, as well as the relations of the texture, organs, and fluids, in the combined exercise of their functions. Simple functional disturbances were thus wholly overlooked, and the constitutional connection of local affections entirely lost sight of.

The cotemporaneous surgery of the period previous to Bichat was marked by its unwillingness to recognize anything but material facts, mechanical processes, and contrivances. The surgeons of those days desired to know nothing but anatomy and mechanics; and, accordingly, it may be recognized as the period of pure anatomical and mechanical surgery, distinguished by the writings of men whose works bear ample testimony that the surgery of the period was founded on exact and even minute anatomical knowledge. No allusion is made, however, by

them to medicine—they make no application of physiological truths, and they encourage no therapeutic tendency apart from mechanical or instrumental interference.

The purely solidist, as well as the purely humoral principles, by which the nature of diseases have been explained, may be said to have died a natural death long ago; but, as already noticed, the remembrance of what is valuable in the results of both are preserved in modern pathology, which takes its stand upon anatomical and physiological facts, connected by simple methods of inductive observation with the symptoms and signs of disease as seen and expounded to the student by the distinguished professors of Clinical Medicine at most of our celebrated schools, where Clinical Medicine is taught.

In this field of instruction it seems invidious to mention here the names of men still living. For their own sakes, as well as for science, may they be long deprived of being thus honourably and respectfully mentioned! As teachers, they are in our own country familiar to every student. As recorders of what they observe at the bedside and after death, they are not less celebrated abroad than appreciated at home.

Tested by extensive clinical observations, the character of the present period in the history of Practical Medicine is one of *probation* as well as of *progress*, marked by a close inductive examination of past generalization and classification of facts, however remotely connected, which illustrate the nature of diseases and their treatment.

Side by side, since 1816 and 1819, the microscope and the stethoscope, under the influence of such men, have advanced our knowledge of the nature of diseases with a regular and accelerated velocity; but they have only done so as assistants and in subordination to laws and facts whose knowledge we have acquired by a close observation of general symptoms. Such instruments have never been intended to take precedence of the close observation of general symptoms. They have never accomplished, nor can they ever accomplish, useful practical results, to the exclusion of such other methods of observation as have just been noticed. We are not to confound *relative* smallness with *absolute* simplicity, and believe that because a simple organic cell is a small object—because we can see around it, through it, and on every side of it—the functions and conditions of its existence are less

complex or less obscure on that account than are those of a more complex organ, or the functions of a living body.

We are not to suppose that because the stethoscope enables us to detect a mitral murmur, or a crepitation in a lung, we are justified at once in adopting one, and only one, method of treatment. It is this exclusive use of instruments, to the disregard of general symptoms and signs of disease derived from close observation and knowledge of the living functions, which leads to the repudiation of the use of such instruments by the sagacious and experienced physician, who sees the numerous errors not unfrequently committed by his younger brethren, who trust too exclusively to these instruments in the diagnosis of disease.

Like the stethoscope, the microscope has been unjustly and unnecessarily burdened with labour, and has been equally unjustly blamed, and brought into unmerited discredit, when it has failed to elucidate the nature or even presence of a morbid state, the existence of which could not be doubted, but which the sense of sight could not appreciate, even when presented in small quantities greatly magnified. In such instances the microscope has been applied to uses which it is not the nature or province of the instrument to detect. The gravimeter or hydrostatic balance, the microscope, the stethoscope, the ophthalmoscope, the laryngoscope, the pleximeter, and the thermometer, are merely instruments of pathological inquiry, each one adapted for the determination of particular classes of facts. They can only elucidate disease when they are brought to bear upon physical properties, the nature of which they are able to appreciate; and it is only from their *combined and appropriate* use, in connection with general signs and symptoms, that our knowledge of the nature of diseases will be advanced.

The industrious employment of these aids to diagnosis, and an intimate acquaintance with the results, are attended with this further advantage, that such practice and knowledge enable their possessor to appreciate the general symptoms of disease with infinitely greater certainty than heretofore. This is the usual consequence of training in all exact methods of observation. The thorough study of these aids to the senses in appreciating disease leads directly to the possibility of dispensing with them in many instances. By means of auscultation and percussion, for example, our attention has been drawn to numer-

ous conditions of the thorax, which enable us to make the diagnosis at the first glance, which hitherto was not possible; because the conditions for diagnosis could never have been recognized without such physical aid to the senses as that derived from auscultation and percussion. Every well-instructed clinical student can now, in many cases, recognize the existence, situation, extent, and stage of a pneumonia from the mere inspection of a patient, and may decide upon the existence of *pleurisy*, *pneumothorax*, *emphysema*, or *pulmonary tubercle*. The initiated are thus frequently enabled to dispense with percussion and auscultation; but if they had never acquired the practical knowledge of the subject—if they had never examined numerous patients by means of these physical aids to diagnosis—and so learned thus to determine with great exactness the significance of the various forms and movements exhibited by the thorax, they would never have been able to appreciate their significance. So, also, the physician well-instructed in the use of the thermometer may, in hundreds of cases, without its aid, draw, with great certainty, conclusions incomprehensible to others not so instructed; but if, led away by this skilfulness, he is induced to dispense with *exact* thermometrical control, he may soon fall into gross errors. So it is with the ophthalmoscope, specula, and all other more or less exact physical aids to diagnosis. Let them be in constant and appropriate use, but the results must always be taken and compared in connection with other general symptoms of disease.

In all the temperate regions of the world, histology, as applied to morbid products, has been cultivated, and has advanced our knowledge regarding disease ever since 1838. In warmer latitudes our knowledge of practical medicine has been advanced by extensive observations on physical climate, medical topography, and by organic chemical analysis applied to obtain therapeutic agents from the vegetable world. Those may be said to be the characteristics of the researches of our own country, Germany, France, and America, as contrasted with the nature of these observations prosecuted in India.

No exclusive doctrine will now stand the test of well-directed pathological inquiry, the main object of which is to connect all organic changes (lesions) and functional derangements with their symptoms and causes, with the view of applying rational

remedies and prophylactics. The too exclusive study of pure organic pathology and morbid anatomy leads to no distinction between the signs and causes of disease; and the obvious tendency of such exclusive study is to exaggerate the importance of the principles it may establish, to hold out no hopes of cure, and to undervalue the power of remedies and remedial measures. To obviate this tendency it is necessary to have recourse to inductive reasoning, so as to connect all the morbid changes seen or appreciated after death with the signs and symptoms of disease observed during life. Thus it is that links in the chain of disease-processes which, from a one-sided or exclusive view, appear isolated and localized, are really found to be connected with each other. It may be, also, that they are connected with a long but intelligible series of processes developed during life through the metamorphosis of tissue, and going on in apparent health or in an obviously morbid exercise of function. The constitutional origin of many local diseases, otherwise inexplicable, then becomes apparent.

Among the more eminent exponents of this rational school of pathology, who at an early period in this country discerned and appreciated such doctrines, we find such names as ALLEN, GOLDING BIRD, SIR ROBERT CARSWELL, GREGORY, HOPE, HODGKIN, MARSHALL HALL, PROUT, WILLIAM STARK, JOHN THOMSON, TWEEDY TODD, and many others, who, although now no more, have left behind them imperishable evidence of their labours. The younger pathologists of the present day, whose name is *Legion*, follow in the footsteps of these men, extending the fields of observation and the boundaries of the science of medicine. By them the importance of morbid anatomy is sufficiently appreciated, and its province distinctly defined and limited as follows, namely:—(1.) To detect the changes which have taken place during the course of diseases in the structure of tissues and organs of the body; (2.) To demonstrate the exact seat of local alterations established during the progress of disease.

The investigation and elucidation of the *nature*, *course*, and *causes* of those changes, constitute the prominent objects of the science of pathology. By the aid of morbid anatomy and clinical observation during life, pathology seeks to establish the relations of the changes which lead to the lesions, and so to connect the general progress of disease with its symptoms and signs.

MORBID ANATOMY goes beyond its province when it attempts to point out the nature of the proximate cause of disease. It is only by the application of inductive reasoning that the connections of causes and morbid effects can be shown, and such constitutes the main object, and is the highest aim of the science of PATHOLOGY.

The *morbid anatomist* finds a lesion or change for what ought to be the natural structure, appearance, or condition of a part. The *pathologist* seeks to connect such lesions with signs and symptoms during life, that the *practical physician* may suggest a remedy to the disease, and that the *nosologist* may give it a name, distinguishing characters, and a place in his classification of diseases.

CHAPTER VI.

THE ELEMENTARY CONSTITUENTS OF LESIONS AS SHOWN BY MORBID ANATOMY AND OTHER MEANS OF RESEARCH.

WHERE the material effects of disease can be rendered obvious they are found to consist for the most part of,—

- (1.) Morphological changes in the elementary textures of the body generally, and altered conditions of the fluids.
- (2.) The presence of new formations foreign to the normal condition of an organ or system of organs.
- (3.) Change in the position or form of some of the organs or parts of organs.
- (4.) Deposits in or around the elementary parts of tissues, or changes of a degenerative or retrograde kind in them.

The object of prosecuting the anatomy of disease is, therefore, in the first instance, to institute a comparison between the known appearances or standard of health and what may be an altered state of the parts. Such a comparison is, in the first instance, founded on an intimate knowledge of the doctrines stated at page 4.

Means and Instruments of Research.—To institute investigations such as those indicated at page 14, advantage must be taken of almost every branch of human knowledge. The methods of car-

on pathological research are, therefore, very varied, but may shortly enumerated under the following heads:—

1 The opening of dead bodies, to ascertain the condition of organs and tissues in all that relates to their structural, chemical, and physical properties. (ROKITANSKY, HASSE, VIRCHOW.)

2 Application of various instruments, such as the microscope, and various means, to ascertain the absolute and specific weight of organs or parts, the relations, size, form, and colours of structures, and the like. (QUECKETT, BENNETT, BEALE, PEACOCK, BOYD.)

3 Application of chemical investigations to the diseased products. (VOGEL, SIMON, DAY, LEBERT, GLUGE, BEALE, GARROD, STURTEVANT, PARKES, VIRCHOW, FRERICHS, GAIRDNER.)

4 Application of statistics to determine various points of interest in reference to the nature, course, and complications of diseases. (WM. FARR, GUY.)

5 Means to preserve objects for further study by the microscope or any other mode of examination. (TULK, HENFREY, VIRCHOW, QUECKETT, VAN DER KOLK, LOCKHART, CLARKE.)

6 Experiments instituted on living animals, and, in certain cases, on man, with the view of artificially producing a morbid condition. A careful study of such experiments by the previously mentioned means affords valuable information, for the causes in which they are more under control than those which are spontaneously brought about by disease in the living body. (BERNARD, HARLEY, VIRCHOW, KUCHENMEISTER, ZENKER, and others.)

The immediate object of such investigations is to obtain information regarding the material changes in the different parts of the body which accompany or produce morbid symptoms, and to connect these changes with symptoms and signs of disease during their progress.

We thus learn how morbid products are formed at first and finally perfected; and by combining these two kinds of knowledge we learn the relative connection of two orders of phenomena; namely, how the perverted properties, disordered actions, and disordered structures give rise to perverted or impaired secretions; disordered and irregular motions; deranged, impeded, or interderanged functions. In other words, the "*order of invasion of diseased processes*" is learned from such investigations, and the nature of complications to which diseases are liable.

We also thus learn how parts, once the seat of morbid change,

return, by various processes of nutrition, growth, repair, or reproduction, to their normal condition.

The questions arising out of such investigations are, or ought to be, the first object of thought to the conscientious medical practitioner. It is his duty, from an attentive consideration of the signs and symptoms of disease, to form an idea, as accurate as possible, of the nature and extent of the morbid action or change which is going on, or which may be set up in the tissues, organs, and fluids of the living body.

If, therefore, he does not avail himself of every means and instrument by which he can ascertain the existence of change in the dead body, and its alteration from some standard of health—if he does not embrace every opportunity of making *post-mortem* examinations—if he contents himself merely with observing signs or symptoms of disease, without witnessing the changes of structure, if any, which may give rise to them—he can have little conscious satisfaction in the study of Medicine as a science, or in the practice of the healing art. In the words of Cruveilhier, he will, during his lifetime, “see many patients, but few diseases.” Such a practitioner is not to be trusted.

Various Forms of the Constituent Elements of Disease.

The histologist has now clearly ascertained the various simple organic forms which compose the textures in their normal state, and the mode in which these textures are arranged and combined so as to form the organs and systems which carry on the healthy functions of the body. The pathologist has also made out (although with less completeness), by the methods of observation and experiment already indicated, the various simple organic forms which constitute the elements of those material changes whose phenomena of growth, decay, and varied change are associated with the manifestations of disease. By classifying and arranging these forms we obtain more clear ideas of lesions; and we also ascertain that the material morbid processes follow, in their development, a very definite order of change, not yet in all cases determined with absolute certainty.

An anatomical investigation of morbid parts, conducted with the aid of the microscope and other instruments of research, shows that the material of which their substance is made up is of very various structure, sometimes combined in forms of one kind

throughout, and sometimes varied by the development and combination of many elementary forms, more or less solid, soft, or fluid.

An analysis of the morbid material, carried as far as scientific means at present enable us, shows that the elementary conditions in which morbid products are found may be described as follows:—

- (1.) Fluid matter and hyaline substance, more or less soft.
- (2.) Simple elementary forms of the nature of deposits, sometimes of a mineral or inorganic character; *e. g.*, (a) amorphous granules; (b) crystalline structures in a granular state.
- (3.) Simple, but organized products capable of growth; *e. g.*, (a) granules; (b) compound corpuscles; (c) simple cells; (d) fibres.

The very various appearances and conditions which these simple forms may assume in disease, as well as the functional states with which they are frequently associated, lead to a further enumeration and classification of morbid elementary products, as well as of more complex disease-processes, as below:—

A.—MORBID ELEMENTARY PRODUCTS.

I. EXUDATIONS MORE OR LESS SOFT, SEMI-FLUID, OR FLUID, AND FORMED OF,—

a. Germinal plastic and formed material, which has sometimes also been called *blastema*, *coagulable lymph*, *false membrane*, or *fibrine*, as seen adhering to free surfaces.

b. Aqueous matter, as seen in the morbid state termed "*dropsy*," and "*œdema*" of parts.

c. Gaseous exudations, as seen in the various forms of *pneumatosia*.

II. EXUDATIONS MORE OR LESS CONSOLIDATED, AND CONSISTING OF,—

a. Molecular or granular material from the 800th of a line to an immeasurably small size, and consisting chiefly of the simple forms of—

- (1.) Fatty molecules or granules.
 - (2.) Forms of an organic kind capable of growth, and invariably taking origin from a pre-existing structure.
 - (3.) Deposits of an inorganic kind, generally calcareous salts.
 - (4.) Pigment granules.
- b.* Coagulable compounds, resisting the action of most re-agents.

such as are seen in the elements of tubercle, scrofula, oleo-albuminous deposits.

c. Exudations of a transitional nature, organized, which are capable of growth, which may become vascular, which grow from pre-existing structures, and which are composed of,—

- (1.) Consolidated homogeneous material passing to
- (2.) A fibrilloid arrangement of the molecular or granular particles composing connective substance, and a subsequent formation of fibres in it or from it.
- (3.) The formation of pyoid cells, and fibro-plastic or connective tissue cells, passing into fusiform cells and fibres as the material becomes consolidated.

(4.) The formation or exudation of fluid matter holding pus, or other more compound cells.

III. GROWTHS AND EXUDATIONS OF A MORE OR LESS SPECIFIC KIND.

- a. Lymph of small-pox and cow-pox.
- b. Matter of glanders, of malignant pustule, and of the plague.
- c. Fluid of infecting chancre, and of some forms of secondary syphilitic lesions.
- d. Material of tubercle and scrofula. (?)
- e. Material of cancer.
- f. The deposit in Peyer's glands during typhoid fever.
- g. The deposit in Peyer's glands in cases of cholera.
- h. Melanotic or pigmentary germs.

IV. MATERIAL OF A COMPLEX KIND.

- a. Media of repair and reproduction of injured or lost parts—substance of granulations and cicatrices.
- b. Hypertrophy of parts.
- c. Tumors, $\left\{ \begin{array}{l} \text{innocent.} \\ \text{malignant.} \end{array} \right.$
- d. Concretions.

V. PARASITIC FORMATIONS.

B.—COMPLEX VITAL PROCESSES WHOSE PHENOMENA, MORE OR LESS COMBINED, CONSTITUTE DISEASE.

1. *Fever*—the febrile state. Pyrexia.
2. *Inflammation*.
3. *Irritation*.

4. *Congestion.*
5. *Depression* (atrophy).
6. *Atrophy.*
7. *Degeneration.*

Such a classification as the above is merely intended to bring before the student at a glance the variety of morbid material which is concerned in the expression of many of those phenomena seen in the course of disease, the distinctions made being mainly based on structural analysis.

While it is more properly the province of the anatomist to describe the MORBID ELEMENTARY PRODUCTS, it is the COMPLEX VITAL PROCESSES, WHOSE PHENOMENA, MORE OR LESS COMBINED, CONSTITUTE DISEASE, with which the physician has more immediately to deal; and some of these complex states especially require notice here; namely, *Fever and Inflammation*, and some forms of *Degeneration*.

CHAPTER VII.

COMPLEX MORBID STATES.

SECTION I.—FEVER—*Pyrexia*.

Definition.—*A complex morbid state which accompanies many diseases as part of their phenomena, more or less constantly and regularly, but variously modified by the specific nature of the diseases which it accompanies. It essentially consists in elevation of temperature, which must arise from an increased tissue change, and have its immediate cause in alterations of the nervous system (VIRCHOW, PARKES).*

Pathology of Fever and Phenomena which constitute the Febrile state.—In describing the nature of fever, the following statements are principally compiled from the Gulstonian lectures of Dr. Parkes, delivered before the College of Physicians in 1855, and from a review by Dr. Jenner on the Proximate Cause of Fever, in *The British and Foreign Med.-Chirurgical Review* for 1856. Knowing how difficult it is to convey an orthodox account of the nature of fever; fully impressed with the great importance of the subject;

and believing, as Dr. Jenner has expressed, "that so consistent a theory of the nature of fever, and one so largely supported by facts, has not been placed before the profession, as that developed by Dr. Parkes, I only hope I may be able to do it justice in the attempt to lay it before the student of medicine in the following form. In the eloquent language of Dr. Parkes, 'I shall have to allude to inexplicable phenomena, to vast spaces still unfilled by solid facts, to spots unknown to observation, and to regions lighted only by the dim and treacherous ray of speculation.'"

"A hot skin, a quick pulse, intense thirst, scanty and high-coloured urine," are phenomena common to many diseases; and when they are present it is said that the patient is *feverish*, or suffers from *fever* or *pyrexia*. There are some diseases in which such symptoms constitute the prominent, and almost the only appreciable phenomena, and which run a more or less definite course, without the necessary development of any constant local lesion. Such diseases have been emphatically termed "fevers," or sometimes *specific*, *primary*, or *idiopathic fevers*. When there are diseases marked by local lesions, attended by the symptoms just stated—such, for instance, as the local inflammations—then the *pyrexia*, *fever*, or *feverish* symptoms which attend them, are said to be *secondary* or *symptomatic*; and the physician is accustomed, when he deals with such cases, to abstract the symptoms of fever from the other symptoms proper to the special affection. In other words, he prescribes, and tries to cure the special affection, and not the *fever*, because he knows that when he has subdued the local disease the *fever* will subside.

It is to the nature of *fever* considered in its abstract relations that the attention of the student is at present directed, and not to any particular fever, such as ague, typhus fever, or the like. It is to *fever* in general, and not to any specific disease, that the following observations apply. It is to the *pyrexial symptoms* which are common to many diseases, such as to *small-pox*, *scarlatina*, *measles*, *typhus*, *ague*, *plague*, *pneumonia*, *nephritis*, *meningitis*, and which, "like shadows to substance, are necessary to the very existence of such diseases, but yet are not, *per se*, any one of these diseases."

Galen defined fever as a preternatural heat—"Calor præter naturam." Subsequently many other additional clauses were

added to this definition, such as "quick pulse," "turbid urine," and the like; but still the improved definition would not meet the requirements of every case; and now it is fully recognized that of all the clauses and phrases in the usual definitions of fever, "preternatural heat" is the only one whose accuracy is unimpeachable. When the feelings of the patient merely were judged from, the accuracy of the observation was often doubted, until De Haen substituted the thermometer for the hand in estimating the temperature of the body, and showed that, "even in the cold stage of an ague, with the teeth chattering and the body shaking, the temperature of the blood is rapidly rising, although the pallid skin, with the supply of blood diminished by the contraction of its vessels, may really be colder than usual. In the severe initiatory shivering of pneumonia or typhus the same fact has been discovered." In short, it is now placed beyond a doubt by the observations of Gierse, Roger, Von Bærensprung, Wunderlich, Friedlander, Virchow, Traube, Jockmann, and others, that, while this preternatural heat varies in amount in different diseases in different persons, and at different times of the same day, it is this preternatural heat which is the essential symptom in fever, which proves fever to be present, and which exists to the extent of 4°, 6°, or even 8° Fahrenheit over the natural limits of health, which averages 98° Fahrenheit, and must be judged of by the temperature in the axilla, as indicated by the thermometer. This preternatural heat is never absent in fever, and without it fever cannot be said to exist. Rigor, which is also sometimes present, is a mere peripheric phenomenon, and the coldness of the skin a subjective sensation, produced by the state of the peripheral nerves, and not due to any actual decline of temperature. "While the outer parts feel cold to the bystander, the inner parts are abnormally warm. While the outer parts freeze, the inner burn." (VIRCHOW, PARKES, JENNER.)

To Dr. Parkes in this country (and to Dr. Jones, of Augusta, U.S., in cases of Malarial fever) is especially due the merit of having clearly and extensively elucidated, by experiment and clinical observation, that this morbid development of heat is associated in some cases with *more* abundant, in other instances with *less* abundant excretions from the body than in health; that the temperature and amount of the excretions bear some undetermined relation to each other; and that the loss of weight of the patient

is due to the increase of elimination, and increased tissue change, associated with the increase of temperature.

So far as physiological facts have elucidated the normal generation of heat in the healthy body, so far has the abnormal generation of heat essential to the *febrile* state been clearly made out. "In the healthy body," writes Dr. Parkes, "the normal temperature produced by chemical change in the body is represented in the excretions by so much *urea, sulphuric acid, carbonic acid, excretive, volatile acids* of the skin," &c.; but in the febrile body the observations of Dr. Parkes show that a higher temperature is represented in the excretions in some cases by a larger, and in others by a smaller quantity of *urea, sulphuric acid, and probably carbonic acid*.*

The most opposite statements have been made regarding the amounts of the excretions in fever, compared with the quantity excreted in health. At present many excellent observers hold that these excretions are always, and of necessity, increased; others, no less exact, affirm that they are invariably, or almost always, diminished. Such discrepancy of statement is due, in the first instance, to the difficulty of collecting and measuring exactly the amount of all the excretions. "Two of the excretions, the cutaneous and the pulmonary, cannot be collected and measured with anything like the accuracy necessary in such an inquiry; even in health such an inquiry is difficult, and in fever it is almost impossible." By careful and accurate observation at the bedside, however, Dr. Parkes has been able to obtain very close approximative data to found his

* In the study of special diseases the student ought frequently to estimate the quantity of *excreta* by the urine, as one of the best methods for enabling him to appreciate the changes which go on in the body during disease. To aid him in prosecuting such researches, he is recommended to consult the work of Dr. Parkes *On the Composition of the Urine*, and to follow the directions given by Dr. Beale, in his work on the *Examination of the Urine*, for obtaining quantitative results by the volumetric method.

Average quantity of urine passed in twenty-four hours, .					52½ to 56 ounces.
Average amount of solids					945 grains.
"	"	<i>Urea</i>	"	"	512 "
"	"	<i>Chlorine</i>	"	"	126·76 "
"	"	<i>Free Acid</i>	"	"	33 "
"	"	<i>Phosphoric Acid</i>	"	"	48·80 "
"	"	<i>Sulphuric Acid</i>	"	"	31·11 "
"	"	<i>Uric Acid</i>	"	"	8·5 "
Specific gravity,					10·20.

conclusions upon, relative to the increase or diminution of the excretions. He assumes that when the respirations are not quickened (*i. e.*, about eighteen times in a minute, or about one act of respiration for every four beats of the pulse), and when the skin is not evidently sweating, the excretions by these two organs are not increased; and, on the other hand, an increased excretion by these organs may reasonably be inferred if the exercise of their function is unusually active, and if there are tolerably copious perspirations. "The other two excretions, namely, the urine and intestinal discharges, can be measured with accuracy, and the urine in particular is a valuable measure of the metamorphoses of tissue. The *urea* alone represents two-thirds of the whole quantity of *nitrogen* which passes off; the *sulphuric* acid (the sulphates of the food being accounted for) represents almost entirely the oxidation of sulphur; and the oxidized phosphorus of the body passes out in great measure, though not altogether, as urinary phosphoric acid. Therefore a careful examination of the urine, and of the intestinal discharges, with an approximative estimate of the pulmonary and cutaneous excretions, gives us sufficiently extensive and accurate materials for the question at issue.

The observations made by Dr. Parkes generally show that the products excreted are of such a kind as to be eliminated, some by *the lungs*, some by *the skin*, some by *the bowels*, and some by *the kidneys*, and rarely by two or more modes of excretion—for when the discharges from the *skin* or *bowels* are profuse, those by the *kidneys* are deficient, as in the last two cases recorded in the following Table I., in which the augmented excretions are printed in italics. The facts thus so carefully observed by Dr. Parkes, confirmed by Alfred Vogel, Heller, and others (but chiefly in regard to the excretion of *urea* only), justify the conclusion—"That increase of temperature may be attended with increased elimination; and therefore presumably with increased tissue change."

TABLE I.—*Abstract of Cases observed by Dr. Parkes in which some of the Excretions are increased in consequence of the febrile state.*

Disease.	Average Temperature above 98°.	Condition of Pulmonic Function.	Condition of Cutaneous Function or Skin.	Condition of Intestinal Function.	Condition of Urinary Excretion.
Rheumatism.	Fahr. 3°	Not noted.	<i>Sweating profusely.</i>	Discharge as usual.	Solid matter excreted greater than in health by 100 grains, and due to urea and sulphuric acid.
Rheumatism.	Fahr. 3°	Not noted.	<i>Sweating profusely.</i>	Discharge not diminished.	Solid matters excreted greater than in health by 200 grains, and due to urea and sulphuric acid.
Typhoid Fever.	Several degrees.	<i>Rapid.</i>	<i>Moist.</i>	Not increased.	Increased by 60 grains.
Erysipelas of Head and Face.		<i>Quick.</i>	<i>Moist.</i>	Unaltered.	Considerably augmented.
Febricula.	Fahr. 3°	Normal.	<i>Enormously augmented.</i>	Confined.	Solids less than normal by 91 grains.
Typhoid.	Fahr. 3°	Not noted.	<i>Sweating and Sudamina.</i>	<i>Diarrhœa profuse.</i>	Solids less by 73 grains.

TABLE II.—*Cases observed by Dr. Parkes in which there was diminution of the Excretions.*

Disease.	Average Temperature above 98°.	Condition of Pulmonic Function.	Condition of Cutaneous Function or Skin.	Condition of Intestinal Functions.	Condition of Urinary Excretions.
Bronchitis of both lungs.	Fahr. 2°·6	20 Respirations per minute.	Not increased.	Not increased.	Less by 112 grains.
Pneumonia acute asthenic.	Fahr. 5°	30 per minute; expectoration scanty.	Slightly moist.	Confined.	Less by 220 grains.
Typhoid Fever.	Considerable.		No sweating.	No diarrhœa.	Below normal amount.
Acute Rheumatism.	Fahr. 4°	Tranquil breathing.	Inconsiderable.	Bowels quiet.	Very small amount of urinary solids.

The abstract given in Table II. shows that another conclusion drawn by Dr. Parkes is equally legitimate, namely—"That the products of metamorphoses, as judged of by the excreta, may be

diminished in febrile cases; and these apparently discordant statements are capable of being explained in various ways. In the first place, it is evident that more chemical change may go on in the body than is represented by the excreta. The metamorphosis of blood or of tissues may not be carried to the point of forming those principles which can alone pass through the eliminating organs. A vast amount of imperfectly organized compounds may be formed and retained in the system, circulating with the blood or thrown upon certain organs." *Thus there may be increased metamorphosis with lessened elimination.* Several pathological facts point to such a conclusion.

(1.) It is in such febrile cases, with diminished excreta, that, at a later period of the disease, copious discharges from one or other of the eliminating organs occur. Thus, in the case of pneumonia referred to in Table II., severe spontaneous diarrhoea came on; and many other cases are quoted, with similar diminution of the excretions at the period of increased febrile heat, in which violent purging, sweating, or diuresis, with increase of urea and of sulphuric acid, subsequently occurred. Such discharges occurring during the progress and towards the termination of a febrile disease have been termed *critical*, the occurrence being called a *crisis*; and the particular day on which it happens, counting from the day of seizure, has been called a *critical day*. The term *crisis* or *critical* is applied because the occurrence of such discharges is usually coincident with more or less sudden fall of temperature, and general improvement in the condition of the patient, whose convalescence dates from the critical day; when, in common language, his disease is said to have "*got the turn*." In such cases, therefore, a large amount of partially metamorphosed substances are retained until they are suddenly discharged, and the system freed from the noxious compounds. Coincident with the critical discharge the temperature is found to fall.

(2.) But in another class of febrile cases retention of the products of metamorphosis is not followed by such a fortunate *critical* issue. At a later period in the history of some febrile cases, with diminished excreta, it is not uncommon for *secondary inflammatory* affections to occur, as if the blood were more contaminated; and it is sometimes observed that in a patient whose excreting organs are acting copiously, there occurs a diminution

of excretion when a simultaneous or subsequent development of local disease becomes manifest.

The following table of cases recorded by Dr. Parkes is interesting from the exactness of the observations and the coincidence of the local lesions with suppression and retention of excreta during febrile states:—

TABLE III.—*Table of Cases observed by Dr. Parkes to show Local Lesions coincident with sudden retention of the Excretions in Fever.*

Disease.	Average Temperature above 98°.	Condition of Pulmonic Function.	Condition of Cutaneous Function or Skin.	Condition of Intestinal Function.	Condition of Urinary Excretion.
Rheumatic Fever. Observed on the 5th, 6th, and 7th day of the disease.	Fahr. 2° Fahr. 2°	No record.	Sweating profuse. Lessened on the 8th day.	No intestinal discharge.	While 400 grains more than in health were being daily excreted, <i>suddenly</i> on the 8th day a diminution of the solids took place by 602 grains; and coincident with this diminution a local lesion became developed (<i>angina faucium</i>). Next day the excretion augmented, and the local affection subsided.
Typhoid Fever.	Fahr. 5° Fahr. 5°	No record.	Great sweating. Lessened much.	Diarrhœa profuse. Diarrhœa ceased.	While the average daily excretion for 8 days was 422·348 grains, a gradual diminution continued for three days to the daily extent of 78 grains, when pleurisy came on.
Rheumatic Fever.		No record.	Sweating moderately.	Unchanged.	Considerable quantity of urine passed, containing an <i>excess</i> of solids; a sudden and great diminution both of the solids and fluids of the urine took place, when the joints again began to suffer, and pleurodynia supervened.

Thus it is evident, from these carefully recorded observations, “that diminished excreta in fever are to be referred to retention of such excreta, and not to a want of formation; and that while the

amount of excreta (capable of being measured) may in fact be small, the amount of tissue-change may nevertheless be great." Another general and practical conclusion is, that the *febrile heat* cannot be measured by the amount of the excretions as a whole, nor by any ingredient of them in particular. Under the same degree of heat and in the same disease different patients pass very different quantities of *urea, uric acid, sulphuric acid, phosphoric acid, cutaneous and intestinal excretions*. The same observations may be made regarding men in health. No two persons pass exactly the same amount of excretory products.

The nature of these excretory products of the febrile state teach us, however, that it is the albuminous or nitrogenous tissues of the body which are being destroyed; for those excretory products, of the urine especially, are the representatives of the azotized structures. The amount of the excretory ingredients of the urine varies considerably from day to day in fever exactly as in health. Often there is a regular gradation of increase and decrease; the *urea*, for instance, may, for two or three days, slightly but regularly diminish in amount, and then suddenly augment to its highest point, again slowly to fall. The same fact may be observed with the sulphuric acid; and Dr. Parkes is led to believe that, both in health and in disease, a certain periodicity, having a range of three or five days, is connected with these gradations of increase and diminution.

The largest amount of *urea* excreted in twenty-four hours in the febrile state is that recorded of a case of pyæmia by Alfred Vogel, namely, 1,235 grains. The largest amount observed by Dr. Parkes was in a case of typhoid fever, in which it amounted to 885 grains. The largest amount of *sulphuric acid* recorded by the same observer, when no medicine was taken, was in a case of rheumatic fever. It amounted to 52·668 grains, and under the influence of liquor potassæ in the same disease, he has known this excretion rise to 70 grains, more than twice as much as in health. The largest amount of *uric acid* excreted during a febrile disease in twenty-four hours, as recorded by Drs. Parkes and Garrod, has been 17 28 grains.

"The amount of tissue destroyed in order to furnish such quantities of excreta must be enormous; and if it is recollected that little or no food is taken by the *feverish* patient, and, therefore, that no materials are supplied for the reconstruction of the textures, thus melting away three

times more quickly than in health, the rapid loss in weight in fever, and the impaired nutritive condition of every organ at its close will be at once evident."

It is not yet determined where the increased destruction of the albuminous textures takes place; that is, whether it occurs in the blood or in the organs themselves. It is only known that both the albumen and the red corpuscles of blood are lessened in amount at the end of a febrile disease; and of the various tissues none appear to waste so fast as the muscles, and especially the involuntary ones (*e. g.*, the heart in typhus fever). The fat of the body is also rapidly absorbed in fevers; and Virchow asserts that the bones also become lighter. While it is known that much of the metamorphosis of these tissues takes place in the normal way, it is also probable, as Dr. Parkes writes, that there is an unhealthy or perverted metamorphosis which leads to the appearance of compounds in the excretions either altogether foreign to the body, or foreign in respect of place and time. There is evidence of this in the peculiar smell of the perspiration, in the peculiar colouring matter of the urine, as well as in the occasional excretion by it of hippuric as well as of lactic and valerianic acids.

Next to the occurrence of preternatural heat in fever, the *excessive retention of water in the febrile system* is perhaps the most remarkable and constant. Notwithstanding the large quantity of water frequently taken to quench the extreme thirst, the quantity of the urine is lessened, and is even scantiest when the skin is driest; and the "concentration of the urine appears to Dr. Parkes almost as good an index of the amount of fever as the temperature itself." The excretion of water by the skin is, as a rule, diminished; and it is a well-known clinical fact that the skin is drier than usual in febrile affections. There is still further evidence of this retention of water in fever. For very early in the febrile state the buccal mucous membrane becomes sticky, and the amount of saliva diminishes. The decrease in the quantity of the gastric fluid during fever has also been proved by the well-known experiments of Beaumont on St. Martin. The intestinal juices, like the gastric, are also probably diminished, for, as Dr. Parkes observes, the stimulus of food is taken away, constipation prevails, and the fæces are dry.

This retention of water in the system cannot at present be

explained; but Dr. Parkes suggests that it may possibly be due to the presence in the blood (or tissues generally) of some intermediate waste-products of the febrile body, of some substance which (like gelatine) has a powerful attraction for water.

Besides water, there is reason to believe that chloride of sodium is also retained to a certain extent in fever, or that it passes off less readily with the urine.

Much has yet to be learned of the nature of fever from investigations regarding the chemistry of the *excretions*, of the *secretions*, of the *blood*, and of the *organs*.

The Urine.—The general characters of this excretion proper to the febrile state are deficiency of water, increase of solids if they are not retained, and especially of the *urea*, the *uric*, the *sulphuric*, the *phosphoric*, and the *hippuric acids*. The *pigments* also are increased; and the *chloride of sodium* is diminished.

The deep colour of febrile urine has usually been attributed to its concentration; but if febrile urine be diluted to the usual amount of fluid contained in healthy urine, it is still darker than normal urine. The colouring matter has been shown by Vogel to be increased sometimes fourfold, and it appears to contain more carbon than usual. This colouring matter in febrile urine is peculiar, and does not give any of the reactions of the bile pigment. It may, according to Dr. Parkes, be considered as a measure of the metamorphosis of the blood globules, which in some cases may thus be four times as rapid as in health.

Another important fact connected with the chemistry of the urine in fever is *the augmentation of its free acidity*, as measured by its neutralization with soda.

The Blood.—The most trustworthy and interesting facts connected with the chemistry of the blood in fever is,—(1.) A diminution of the alkaline salts, as shown by Becquerel and Rodier in inflammation; (2.) A diminution of alkalinity of the serum, as shown by Cohen; (3.) The diminution of the albumen after the fever has lasted for some time, with a commensurate increase in the water of the serum; (4.) A diminution in the numbers of the red corpuscles of the blood; (5.) In certain specific fevers the presence of *uric acid* has been detected; for instance, in rheumatism, by Dr. Garrod.

Of the Pulmonary excretion, in the febrile state, little is known.

Some have found the carbonic acid augmented, others have found it diminished. Dr. Wilks, of Guy's Hospital, found that the ratio of respirations to the pulse is always increased, and that the pulse may be descending while the respiration remains high: such phenomena he considers indicative of a positive increase of function of the lungs.

It is important to determine when the blood becomes affected in fever. It has been, and still is, a favourite opinion to refer the *origin* of fever to primary disease of the blood; and in almost all specific diseases, such as in the *miasmatici*, a *fever-making cause* appears to enter the blood; at least, writes Dr. Parkes, it may be proved to enter in several cases; and a strong analogical argument can be proved of its entrance into the rest. The fever-making cause also reproduces itself in the blood, or in some organs; and it is now generally admitted that the first action of the febrile cause is on the blood.

The Nervous system seems to play so important a part in fever that Virchow, in his definition, states that the essential phenomena *must have* their immediate cause in changes of the nervous system.

It is very difficult to substantiate this position, but the following general results prove the great influence of the nerves in febrile affections. Taken individually they no doubt will impress different minds with different degrees of force, while collectively they cannot fail to furnish an argument in favour of the essential participation of the nervous system in fever.

(1.) There is the generally received physiological law that nerves regulate the metamorphosis of tissue and the production of heat, both of which are altered in fevers. (HELMHOLTZ, LUDWIG, BERNARD.)

(2.) There are those experiments on the vagus nerve which bring about febrile phenomena, such as increased cardiac action, pulmonary congestion, anorexia, and nausea. (BERNARD, PAVY.)

(3.) There are those arguments derived from the various symptoms which announce, accompany, or terminate fever. (a) The remarkable depression, apathy, sense of exhaustion and debility which usher in the febrile state. (b) The shiverings, the contraction of the superficial vessels and of the skin. (c) The increased rapidity of the heart's action, and the relaxation of the vessels, which soon follows the stage of contraction just

noticed, or occurs without it. (d) The congestion of the lungs. (e) The periodicity of some of the phenomena of fever, and the occurrence of death or recovery on so-called critical days. (f) The abnormal state of the secretions.

(4.) The fearfully rapid death which sometimes ensues in the early stage from some unknown cause, may with justice be referred to profound nervous lesions; for there is great prostration, a galloping and early-failing pulse, and an excessively rapid respiration.

(5.) The effect of certain remedies, such as quinine, upon periodical febrile phenomena.

Causes or Influences which combine to produce the complex phenomena of Fever.—They are enumerated by Dr. Parkes as follows:—

“First of all we must place the entrance into the blood of a morbid agent, and the alteration of the blood to a certain extent under its influence. Perhaps this occurs under the incubative period, when often there is no rise of temperature, no fever; that is, when no appreciable alteration of the general health can be discovered. The nature of the change in the blood is unknown.

“Then, secondly, when the change in the blood has reached a certain point, the nervous system, or rather that part especially connected with nutrition and organic contractility, begins to suffer changes in composition, which probably impede or destroy the normal molecular currents. When this occurs, the nervous symptoms of weakness, depression, rigors, and contraction of some parts and vessels, speedily followed by relaxation, mark the stage of invasion.

“Thirdly, and simultaneously, various parts, especially the muscles, and probably some of the organs, deprived in greater or less degree of nervous influence, begin rapidly to disintegrate, and by their disintegration produce supernatural heat.

“Fourthly, this metamorphosis is aided, in most cases, by the condition of the vagus and vasi motor nerves, which cause increased action of the heart and dilatation of the vessels.

“Fifthly, the contamination of the blood, already produced by the morbid agent, is increased by the check which the normal extra-vascular currents experience, by the pouring into the blood of the rapidly disintegrating tissues, and by the continued action of the morbid agent, which in almost all cases appears to act more rapidly and more powerfully in blood rendered impure in any way, either (as shown by Dr. Carpenter) by retention of excretions, absorption of septic substances, or, as in fever, by the too rapid metamorphosis of tissue.

“Sixthly, the various organs suffer (apart altogether from specific changes), and must, one would think, produce increased deterioration of

the blood. Thus the lungs are congested in so many cases that we can scarcely suppose proper aëration to go on; the liver would seem, from Frerich's observations, to be, in some cases at any rate, in a most abnormal condition, and to produce compounds, such as leucin, unknown in health; and the spleen in many fevers, if not in all, enlarges (in persons of a certain age), and is congested, possibly even to extravasation.

"Seventhly, food being almost withdrawn, the various alkaline and neutral salts no longer pass into the system."

All these events and circumstances tend to render the state of fever an extremely complex one.

Diagnosis of Pyrexia, and usefulness of the Thermometer at the Bed-side.—There are certain phenomena especially related to the development and progress of fever, which ought to be determined by clinical observation and experiment in all cases of disease where fever may be present. The facts to be ascertained are not less significant of the abatement, subsidence, or "*defervescence*" of the febrile state than of the advent of local lesions. The term "*defervescence*," in fever, is a comparatively new one in English pathology. It was first used by Professor Wunderlich, and subsequently adopted in this country by Dr. Parkes. It signifies the period in which the temperature of the febrile body is declining to its normal amount from that intense degree of heat attained in the state of accession of the febrile phenomena. This "*defervescence*" may be sudden, when it is regarded as a "*crisis*;" or it may be gradual, and is then described as a "*lysis*;" or it may be partly sudden and then slow, when it may be described as "*wave-like*," with gradual and sometimes regular alternations of high and low temperature, as Dr. Parkes was the first to point out. (*The Composition of the Urine in Health and Disease*, p. 270.)

It is the exact sequence of phenomena we desire to know in every case where pyrexia is present, as well as the meaning and co-relation of the phenomena: and usually symptoms sufficiently characteristic become developed and superadded to the febrile phenomena, by which the physician is able to define the specific nature of the disease or fever as a whole, and to say of this case or of that, "It is a *typhoid fever*," or "It is an *ague*," or "It is a *rheumatic fever*," or "a *pneumonia*," or "a *dysentery*," or any other form of illness where pyrexia is present, which we are able clinically to recognize. It is not very long since we were able to

do this. Up till within a comparatively short time ago, the classification and diagnosis of "Fevers" was not such as to distinguish and separate their varied forms and varieties from each other. "Common continued fever" was a comprehensive name which included many very different types of fever; and no means of observation have been of late so exactly discriminating, by helping the physician to distinguish one form of disease from another where fever co-exists, as accurate observations on the temperature of the patient, determined by the thermometer. In acknowledging this great fact, it is important to observe that the absence of such exact observation, and the trusting to general signs alone, have hitherto led to great confusion—a confusion which has been most unjustifiably and unfortunately increased by a pernicious system—becoming too common—of naming "Fevers" by the place or locality where supposed varieties of fever have prevailed as epidemics; or by the use of local or provincial native names. For example, the Walcheren Fever, Levant Fever, Mediterranean Fever, Crimean Fever, Bulam Fever, African Fever, Fernando Po Fever, Lisbon Fever, Bengal Fever, Pucca Fever, Gall-sickness of the Netherlands, Hong Kong Fever, and other names not less barbarous, may be quoted. Except as matter of history, and as beacons to warn us from the danger to science, let these and such-like names be consigned to oblivion. With the exact means at the disposal of the physician as aids to diagnosis (and which are about to be described), every variety of illness where fever takes a part may be accurately distinguished, its type recognized, and its place fixed in nosology; or if it should be anomalous, its exact departure from the type may be not less accurately defined and described.

To Professor Wunderlich, of Leipsic, the science of Medicine is indebted for his exposition and persevering advocacy of the usefulness of daily repeated observations and records of the temperature of fever patients, and the constant employment of the thermometer as a means of diagnosis at the bedside. On this subject he has written much, from an extensive experience, embracing at least half a million exact thermometrical observations, following the continuous progress of individual diseases, the results of which are compared in more than 5,000 patients. He constantly employs the thermometer in his private practice, and bears unqualified testimony to its sterling value in the early

detection of disease, and as an instrument which furnishes information of great importance as a guide to treatment. When the physician once becomes accustomed to this method of investigating disease, he regards the daily employment of the thermometer as indispensable, for it imparts to him a certainty attainable by no natural penetration, and which no other method of investigation can convey.

The following statement of the chief practical points to be attended to in the diagnosis of disease, where it is important to determine the beginning, the development, the persistence, and the defervescence of fever, or the advent of local lesion, is compiled from the writings of Wunderlich, of which an excellent abstract was published in the *Medical Times and Gazette*, June 19, 1858, and September 28, 1861. More detailed results are published by the assistants or pupils of Wunderlich in the *Archives für Physiologische Heilkunde*, 1860, p. 385, and 1861, p. 433; and the principal conclusions have been summed up by Wunderlich himself, in his *Handbuch der Pathologie*.

I.—*Data relative to the Temperature of the Body, as a Guide to the Pathological Value of regularly continuous Thermometric Observation, in the Diagnosis and Prognosis of Disease where FEVER may be present.*

1. The normal temperature of the human body, at completely sheltered parts of its surface, amounts to 98°·4 Fahr. (29°·5 R.), or a few tenths more or less. A normal temperature such as this is not an absolute proof of health, but any notable deviation from the normal temperature—for example, a rising above 99°·5 Fahr. (30° R.), or a depression below 97°·3 Fahr. (29° R.)—are sure signs of the existence of disease.

2. Deviations from the normal temperature are never without a cause, and are always significant. Their appearance; their range, and their fluctuations are always of grave importance; and they invariably follow certain distinct laws. On the one hand, they are the result of accidental influences on the body; on the other hand, they result from the existence of morbid processes within the body.

3. The normal temperature of healthy individuals is all but unchangeable; according to the accurate observation of Traube, it varies only to the extent of 0·54 Fahr. (half a degree), and is

generally due to food having been taken. The most varied influences to which a healthy person may be exposed, so long as they do not induce disease, scarcely cause a variation of half a degree; and the maintenance of an equal normal temperature, under all circumstances, indicates a healthy constitution. A man in good health, whether fasting or digesting, drinking water or stimulating fluids, actively employing his mind or his body or living in a state of listlessness, always retains the same equable normal temperature unless his health becomes disturbed. In sleep the temperature of a healthy man is somewhat lower; but even then it does not sink below $97^{\circ}.3$ Fahr. (29° R.). The maintenance, therefore, of a normal temperature, under all these various influences, gives a complete assurance of the absence of anything beyond local and unimportant disturbances.

4. Variations of bodily temperature, through external influences, indicate disturbed health. Influences which exert no effect on a healthy man act most strikingly in certain abnormal conditions of the body, so that the appreciation of such changes in the temperature will often alone indicate latent but important disease. A mere indisposition, but attended with a considerable rise of temperature, ought never to be made light of, marking, as it usually does, the beginning of important disease. Many men, apparently healthy, carry in their bodies the germs or the remains of disease, while the most careful general observation (apart from thermometric observation) may fail to detect anything abnormal. Such persons may be in no inconsiderable danger; for, by a want of precaution, disease may unexpectedly arise. Convalescence, also, may be incomplete, so that patient and physician are alike thrown off their guard, and the simplest precautions neglected. A rise of temperature will invariably suffice to indicate a relapse, or the advent of another form of disease, which, by due precautions, may be warded off. A rise of temperature in the convalescence of typhus fever ought to convey most important warning. Intermittent fevers, also, are attended by oft-recurring exacerbations of temperature. If these are dissipated by quinine, the patient recovers; if they are allowed to pass over and recur, we expect a relapse. So long as such convalescents are in a state of repose, their temperature may remain unchanged; but no sooner do they become disturbed by some excess in diet, a slight increase

in the number of the stools, a small loss of blood, or the like, than the temperature at once undergoes a considerable elevation—even to 100° Fahr., or higher.

5. Deviations from the normal temperature in certain diseases are stable in proportion to the typical character and full development of the particular disease. But even in such diseases we may have an increase or decrease of temperature proper to the disease brought about by *accidental* influences. Such instability, however, is only temporary, and of short duration, when the *accidental* influences act but *transitorily*. For example, the temperature proper to the disease may be lowered under the influence of a profound sleep, bleeding, epistaxis, the relief of constipation or of the retention of urine, and the like; or it may be raised after excitement of a mental kind. But any such alterations, unless they are dependent upon a change in the disease-process itself, will become effaced after twelve or twenty-four hours at the most, when the temperature again resumes the typical character diagnostic of the particular disease.

6. The temperature of the body is in most cases the most certain means (although not the only means) for determining the real state of the patient as regards morbid disturbances; and its consideration is indispensable for an accurate prognosis. When disease has actually established itself, the thermometer is not only the most certain basis of diagnosis, but often it is the best corrective of a too hasty conclusion; and frequently it affords the ultimate means of deciding in doubtful cases. Even in the best marked forms of disease diagnosis is often difficult, and observations on the temperature seem to be superior to all other means in ultimately and definitely solving the difficulty. For example, the characteristic variations of the temperature, as exhibited in a typical case of enteric, intestinal, or typhoid fever, are of such a kind that they are not found in any other disease. Intestinal catarrh, severe forms of pneumonia, intermitting fever with apparent continuance, meningitis and miliary granulations of the pia mater, acute tuberculosis, Bright's disease, or pyæmia, may each simulate typhus, and may exhibit some of its most characteristic symptoms; but observation with the thermometer as to the temperature of the patient from day to day, will at once, or after a very few days, establish the distinction with certainty. In the course of many diseases, also, whose diagnosis has been accurately

established, additional developments of disease, degeneration, or other complications, may ensue, which at first, and for a time, are otherwise completely hidden, if the interruption to the normal course of the disease is not marked out by a sudden rise of the temperature—the earliest and the best indication of these untoward events.

7. The temperature in disease may be *normal*, *lower*, or *higher*; and it may be unequally distributed over different regions of the body.

8. The *normal* temperature in disease is to be regarded only as a relative sign. Its presence excludes certain forms of disease; and when compared with former elevations or depressions of temperature, it shows that an interruption to the course of the disease has taken place, or that the patient is approaching recovery; and when once the typical range of temperature in the course of a particular disease is known, the basis is laid for appreciating any irregularities in particular cases. For example, a patient exhibits symptoms of fever of the typhoid type (enteric or intestinal fever); but during the progress of the first week the temperature of his body becomes normal, for however short a space of time; and the occurrence of this normal temperature during the first week proves conclusively the non-existence of *typhus* fever. Again, a patient may suffer from symptoms of incipient *pneumonia*; and there is a doubt as to whether or not there has occurred a hæmorrhagic infarction of the lung substance. The sputum does not assist the diagnosis, either because it is suppressed or not procurable at the moment. If, however, the temperature is found to be normal, it is certain that no croupous pneumonia is developing. Again, in a case of whooping cough, the physician is certain that no inflammatory complication has taken place so long as the temperature is normal. Further, a patient after a severe precursory fever has a copious variolous exanthemata; but simultaneously with the appearance of the eruption, the temperature of the body becomes normal, and then the physician is certain that eruption will not be true variola. Again, a tuberculous patient has a sudden attack of hæmoptysis. If the temperature of his body is normal during and subsequently to the attack, no reactive pneumonia, nor any tuberculous reaction, need be expected. Also, in all cases of convalescence, so long as the temperature remains normal, no relapses need be feared, except such as may be of a

purely nervous nature. Lastly, in cases of intermittent fever, if at the time at which the paroxysm is expected the temperature does not rise, the attack will not appear; and if a second period comes round without the paroxysm developing itself, then convalescence may fairly be expected.

9. In cases of abnormal increase of temperature both the maximum height and the rapidity of the changes require to be noted. A sensitive thermometer placed in the axilla will (if there is considerable elevation of temperature) rise above the normal temperature within the *first minute*, and will exhibit the actual temperature in *five minutes*. If the instrument be warmed in the hand (or as the surgeon warms a catheter) to 97°·3 Fahr. (29° R.) before applying it, an accurate indication may be obtained in one or two minutes. The quickness of the rising is found to depend upon the height of the existing temperature; so that, from observation of the rapidity with which the column rises, the physician is able in half a minute to form an approximative judgment of the amount of rising to be expected.

10. Abnormal increase of temperature is usually observed in connection with changes in the sensations of the patient, such as languor, lassitude, chills, heats, thirst, headache, and the like, and with increased quickness of the pulse. Still a considerable abnormal increase of temperature (4°·5 Fahr. = 2° R.) may occur in a state of *apparently* good health, the pulse being still normal. Elevation of temperature, as measured by the thermometer, is therefore a more decided sign than the feelings of the patient or the condition of his pulse; and there are many cases in which the physician, without thermometric observation, could not appreciate the existence of fever. Several hours prior to the paroxysm of ague, the temperature of the patient's body commences to rise; and frequently, when the disease seems to have completely disappeared, an increase of temperature may be detected to occur periodically, unaccompanied by any other symptom. So long as this periodic rise of temperature continues, the patient is only apparently cured. In the exacerbations of typhoid fever, also, the rise of temperature will indicate what is about to happen three or even four days before any increase of pulse or other sign of mischief has been observed. In tuberculosis, also, it is the persistent increase of temperature alone which will frequently show that no arrest in the process has occurred; and in many *apyrexial*

diseases, as well as in every description of convalescence, the thermometer is the earliest of means which will indicate the development of complications.

11. The amount of abnormal increase of temperature is usually proportionate to the degree of frequency of the pulse, and to the other signs of general disease. Yet such congruity of phenomena is sometimes in part or wholly absent or incomplete; and in the cases in which a disproportion or incongruity exists between the increase of temperature and the pulse or other febrile phenomena, it is the accurate measurement of the temperature which is most of all to be relied upon. As a general rule the normal temperature of $98^{\circ}3$ Fahr. corresponds with a pulse of seventy beats per minute; and an increase of temperature of *one degree* corresponds with an increase of ten beats of the pulse per minute. Thus a temperature of 100° Fahr. ought to correspond with a pulse of 80; a temperature of 104° Fahr. with a pulse of 120; and a temperature of 106° Fahr. with a pulse of 140 per minute.

12. A single observation of an abnormal increase of temperature (whether great or small) is not alone sufficient to indicate the nature of the disease. When the temperature is increased beyond $99^{\circ}5$ Fahr. it merely shows that the individual is ill, and suffering from some disease; that when considerably raised he is suffering from fever, as with a temperature from 101° Fahr. to 105° Fahr.; and that when a great height is reached, as at temperatures above 105° , the patient is in a state of imminent danger; and that with a rise of temperature beyond 106° Fahr., and up to 108° Fahr. and 109° Fahr., a fatal issue may almost without doubt be expected in a comparatively short time.

13. A single observation of abnormally increased temperature (taking into consideration the other conditions of the patient) may sometimes enable the physician to determine the character of the disease present, or the absence of other diseases originally suspected; but it is very rarely indeed that a definitive diagnosis can be based upon a single observation; and the following are some of the few cases in which one observation may be sufficient to establish a certain diagnosis upon:—

A person who, yesterday, was healthy, exhibits this morning a temperature above 104° Fahr. (32° R.), is almost certainly the subject of an attack of ephemeral fever, or of intermittent fever; and should the temperature rise up to or beyond $106^{\circ}3$ Fahr.

(33° R.), the case will turn out to be one of intermittent fever. Again, a patient under eighteen years of age shows the general symptoms of typhus fever. One evening during the second half of the first week of illness, or during the first half of the second week, the temperature of his body sinks below 103°·3 Fahr. (31°·7 R.) without any external cause—a certain indication that the fever is not typhus. Again, a patient whose temperature rises during the first day of illness up to 106° Fahr. = 33° R., it is certain he does not suffer from typhus. Further, a patient exhibits the general typical symptoms of pneumonia; but during the development of the disease, if his temperature never reaches 101°·7 Fahr. = 31° R., it may be safely concluded that no croupous or soft infiltrating inflammatory new growth is present in the lung. Lastly, if a patient, having suffered from measles, still retains a high temperature after the eruption has faded, it may be concluded that some complicating disturbance is present.

14. A single observation of the temperature, *with other means of diagnosis*, will not unfrequently determine whether the disease is one of danger or not. The reason why other means of diagnosis besides temperature ought to be taken into account is, that the observation regarding the temperature might happen to be made during a temporary improvement or aggravation. Bearing this in mind, the following examples may be quoted, in which an important conclusion may be drawn from a single observation:—In typhus fever a temperature which does not exceed on any evening 103°·5 Fahr. = 31°·8 R., indicates a probably mild course of the fever, especially if the increase of temperature takes place moderately towards the beginning of the second week. A temperature of 105° Fahr. = 32°·5 R. in the evening, or of 104° Fahr. = 32° R. in the morning, shows that the attack is a very severe one, and forebodes danger during the third week. On the other hand, a temperature of 101°·7 Fahr. = 31° R., and below, in the morning, indicates a mild attack, or the commencement of convalescence. Again, in pneumonia, a temperature of 104° Fahr. = 32° R., and upwards, indicates a severe attack; and a similar height of temperature in acute rheumatism is always an alarming symptom, forboding danger, or some complication such as pericardial inflammation. Further, increase of temperature in a mild case of icterus indicates a pernicious turn; in a lying-in woman it is a sign of approaching inflammation; in cases of tuberculosis it shows that

the disease is advancing, or that untoward complications are setting in. In short, the presence of the *fever-temperature* (104° Fahr. to 105° Fahr. = 32° R. to $32^{\circ}5$ R.) in any disease indicates that its progress is not checked, and that complications may still occur.

15. The abnormal temperature proper to the various forms of disease does not remain completely equable during the twenty-four hours; and daily fluctuations are in part dependent upon general rules, either universally valid or in part determined by the nature, stage, or degree of the disease, or upon its increase or defervescence.

If graphic representations of the daily temperatures are laid down, it will be seen that the diurnal curve which marks the temperature corresponds with the remission or exacerbation of the fever during the day. In non-intermittent febrile affections the temperature generally is less high in the morning than in the evening—this morning remission being measured by a decrease of temperature to the extent of about 1° Fahr. = $\cdot5^{\circ}$ R., or a little over.

Stability of temperature, or the retention of the same temperature from morning to evening, is in general a good sign—a sign of improvement; on the other hand, when the temperature continues the same from evening till morning, it is a bad sign, indicating aggravation of the disease.

In typical cases of disease a fall of temperature from the morning to the evening is a pretty certain sign of improvement; on the other hand, a rise of temperature from the evening till the morning is a sign that the patient is getting worse. A fall of temperature of more than 1° Fahr. = $\cdot5^{\circ}$ R. from the morning to the evening is a more certain sign of improvement than a fall of 3° Fahr. = $1^{\circ}5$ R. from evening to morning.

A sinking from a considerable height (106° Fahr. = 33° R., or more) down to the normal temperature within twenty-four hours occurs but very rarely—in ephemeral fevers, for example, and in a few exanthematous fevers, such as measles, variola, and the like. It occurs transitorily—that is, with a re-increase the next day—in intermittent fevers, in certain periods of typhoid (enteric or intestinal) fever, more rarely in pneumonia, typhus, and pyæmia.

The fall from a high morning or noon temperature to the normal evening temperature is confined to cases of intermittent fever, and a few instances of pyæmia.

A decided and early re-increase of temperature in the morning (except in the case of intermittent fevers) is always a sign of a progressively severe disease; and the continuous increase of the evening temperature up to and beyond midnight is always a grave symptom.

16. Accidental deviations from the typical daily curves of the temperature in febrile diseases are generally brought about by very various circumstances; the most common of which are, the occurrence of complications; the sudden aggravation or abatement of the disease by retention or copious evacuations of the solid excretions, by purging, by the emptying of an overcharged bladder, by spontaneous or artificially induced bleeding, by excitement, by errors of diet, or by the action of medicinal agents; and, lastly, by the natural or spontaneously favourable turn of the disease.

17. Regularly continuous thermometrical observations teach the typical laws of particular forms of fever, and supply us with the most important basis as a standard of comparison for particular cases. Such continued and regular observation is the only means of ascertaining with exactness the normal process of development, defervescence, and convalescence to complete recovery in febrile affections; and, when the physician is possessed of such typical knowledge, he is enabled to appreciate the effects of special circumstances in individual cases; and especially the influence of the therapeutic agents which he may use. Such knowledge, however, is only to be acquired by the repeated observation of numerous cases; and the more general the study of thermometry becomes, as applied to the diagnosis of disease, the more numerous and well-grounded will be the ultimate practical results.

18. Regularly continuous observation of the temperature in diseases of a febrile nature may alone enable the physician to establish a completely certain diagnosis of the nature of the disease; and, at the least, it supplies such valuable material for diagnosis, that frequently it is the chief or only means of deciding doubtful cases. The regularity of the typical thermometrical variations in the course of febrile affections is so constant, and so much to be depended upon, that the differential diagnosis of such diseases as *ephemeral*, *intermittent*, *typhus*, and *scarlet fever*, *small-pox*, *measles*, *acute rheumatism*, *erysipelas*, *pneumonia*, *pyæmia*, may be established by observation of the temperature. The character of the curves of daily temperature, or the materials

to form them, will be given under the description of each of these diseases.

19. In cases of doubtful diagnosis, not only amongst the diseases already named, but also in cases of such diseases as meningitis, miliary tubercle, peritonitis, and the like, the temperature observations furnish most reliable prognostic and diagnostic indications.

20. Regularly continuous observation of the temperature during the whole progress of a case shows unmistakably its periods, cycles, or stages, and exhibits the points of transition from one stage into another. It enables the physician to distinguish, for instance, the periods or cycles of progressive development of the fever, the period when it has attained its height, the period of defervescence, and of incipient convalescence towards complete recovery. It is important to determine such stages, especially in febrile affections where lesions of internal organs occur, as in typhoid or intestinal fever. The slowly healing process connected with the lesion in Peyer's glands, for example, has often been regarded as a continuation of the fever, while the lesion has dangers peculiar to itself, calling for special and peculiar treatment, after the fever has abated. By no other means can the progress of such concealed lesions be better appreciated than by observations on the temperature.

21. Regularly continuous observation of the thermometer exhibits with the utmost exactness the degree of probable slightness, severity, intensity, or absolute danger of the disease, as well as its changes, its improvements, or aggravations. There are certain limits of temperature—and these vary—within which a severe or slight attack may be said to exist. Thus the practical application of the thermometer is not confined to merely nominal diagnosis; for while it is of importance to recognize the nature of a case of *continued fever*, and also to distinguish it from any other disease, such as a *pneumonia*, it is of not less consequence to be able as soon as possible to know whether the case will be a severe one or a slight one. There is no method of arriving more certainly, more delicately, or more promptly at this result than by early observations on the animal temperature. Thus, amidst many appearances otherwise deceptive, a case of typhus may be foretold as a mild one, and so distinguished from a severe one, as early as the first week of the disease.

22. Regularly continuous observation of the temperature will indicate any irregularities in the normal development of a disease, and whether these depend on accidental circumstances or the operation of remedies; and, when once the typical or normal course of a disease is known in relation to the temperature of the patient's body from day to day, it is easy to detect and to appreciate the irregularities in individual cases. A great field is here opened up for investigation, namely, as to the influences which tend to render the course of a disease irregular, and the changes of temperature which may be due to age, constitution, and the operation of remedies. Deviations from what ought to be the normal curative process are also thus easily appreciated, which otherwise would be concealed. The delayed defervescence in *pneumonia*, the pre-existence of a high evening temperature in *typhus*, or in the *exanthemata*, the incomplete attainment of the normal temperature in apparent convalescence, are signs of great significance. They indicate incomplete recovery, supervention of other diseases, unfavourable changes in the products of disease, or the continuance of other sources of disturbance requiring to be examined into; and the commencement of even a slight elevation of temperature during convalescence is a warning to exercise careful watching over the patient, and for the maintenance of a due control over his diet and actions.

23. Regularly continuous observations of the temperature exhibit the precise point at which the disease-process terminates, and the degree of its complete development. When this point has been determined on, a retrospective view may be taken of the character of the disease, as to the purity of its typical form or its complexity, and a prognosis may be hazarded as to the probability or doubtfulness of recovery. The morbid process has not terminated till the normal temperature of the body returns, and remains unchanged in the evenings and throughout all periods of the day. The transition from the febrile state into defervescence is either slow (lysis) or rapid (crisis). A regularly continuous defervescence is always a sure sign of convalescence. Its occurrence will save other investigations: irregular defervescence, on the contrary, indicates a disturbed and protracted course of convalescence, which requires careful watching and judicious nursing.

It is also of particular practical importance to know that the fall of temperature during the period of recovery, in cases of con-

siderable morning remissions, as well as in those of continued defervescence, may be abnormally large, and sink as low as 28° R. = 95° Fahr., or even lower. Such events constitute collapses during defervescence, which must be counteracted by artificial heat, the administration of warm drinks, or even of such stimulants as wine or camphor, unless some unexpected new danger should interfere with an otherwise favourable course of the disease.

24. During convalescence the recurrence of a high temperature is generally the first sign of an approaching relapse, or the onset of a new disease, the characteristic symptoms of which it may precede by several days. The persistence of even an inconsiderable degree of abnormal temperature after apparent return to health is a certain, and frequently for a long time the only, sign of incomplete recovery, or the existence of some lingering secondary disease. Thus the temperature should be closely watched during convalescence; and the thermometer should be applied every other evening at the very least. As long as the temperature remains normal, nothing need be feared; but every rise of temperature should act as a warning. It may be due to mere error in diet or to leaving bed too early; but in such cases the temperature soon sinks again, on greater precautions being taken.

25. Regularly continuous observations on the temperature alone, or in connection with other symptoms, may enable the physician to predict a fatal issue with certainty, or the probably near approach of death. On this point one of two conditions may be observed, —(1.) The temperature may rise continuously and considerably above 33° R. = $106^{\circ}2$ Fahr., when it is a bad sign; or it may even reach 34° R. = 110° Fahr., when a fatal issue is almost certain; and it not unfrequently happens that, after the apparent occurrence of death, the temperature still continues to rise one or two-tenths R. = 1° or 2° Fahr., the cooling of the body taking place very slowly. Wunderlich records a case of spontaneous or rheumatic tetanus, in which the temperature exceeded the maximum that has ever yet been observed in any disease. The heat only began to increase within the last twenty-four hours before death; but the other symptoms before that time had been very violent, the respirations being accelerated, and the pulse at 102. During the night previous to death the temperature suddenly rose $3^{\circ}3$ Fahr., while the velocity of the pulse and the frequency of

the respirations diminished, and the other symptoms did not increase in severity. Shortly before death the heat rose to 110°·75 Fahr., the pulse being then at 180; and at the moment of death the thermometer was at 112°·5 Fahr. After death the temperature still rose, and was found to be 113°·8 Fahr. an hour after the fatal event. It then slowly diminished; and thirteen and a half hours after death the temperature had not yet fallen to the normal average of the living body. (2.) The temperature may become more or less moderated, while the pulse is increased in frequency, and the other symptoms become more and more threatening. Such diminution of temperature, amidst conditions which do not harmonize with it, must be regarded as a pretty certain sign of approaching dissolution. But, on the other hand, there are also cases in which the observation of the temperature yields the most favourable signs for prognosis. For example, when it is found, in a bad case of *typhus fever*, that the temperature has fallen some morning to 30° R. = 99°·5 Fahr., we know that the reparative stage is entered upon; and when a similar fall of temperature is observed in the evening, convalescence has commenced. In *pneumonia*, when a marked fall of temperature occurs in the evening, it shows that the period of crisis has arrived. When the temperature falls in *measles* the maximum severity of the eruptive stage has been reached; and when, in the first stage of *variola*, we observe a quick return to the normal temperature, we may feel certain that a slight form of the disease, free from danger, is likely to ensue.

26. A decrease of temperature below the normal heat is rare. It happens sometimes transitorily, announcing thereby a favourable crisis, by preceding the return to a normal temperature. It is also met with sometimes during the morning remission of *remittent fever*; also during the apyrexia of *intermittents*; in acute collapse, preceded or not by fever; in chronic wasting diseases; and sometimes, also, on the approach of death.

27. A remarkable inequality in the distribution of the temperature over different parts of the body (face, hands, feet, &c.) may occur during the shivering preceding fever, in collapse, and in the agony of approaching dissolution. Sometimes, also, such unequal distribution may occur in disorders of the chest and abdomen, in some local skin diseases, and in partial paralysis. This fact is not of importance or utility for diagnosis or prognosis;

but it requires to be known, in order that erroneous conclusions may not be drawn.

II.—*Practical Rules as a Guide to the regularly continuous determination of the Temperature of the Body in Diseases where FEVER may be present.*

1. It is necessary to have a good thermometer, with a uniform and correct scale, having a range from 25° R. to 35° R. = 88° ·2 to 110° ·7 Fahr., exhibiting also 10ths R. = 5ths Fahr. of degrees.

2. It is necessary, also, to compare the thermometer used with a standard one, and note the differences *between every degree*. A thermometer is bad, and all but useless, if the differences between various degrees are unequal, but is quite serviceable if the same sum is to be added or subtracted for *each* degree. The price of such an instrument is moderate; therefore it need not be difficult nor expensive for a student to acquire a competent practical knowledge of "the thermometry of disease."*

3. One and the same patient ought to be examined continuously with the same instrument. It is therefore desirable to have a number of thermometers, so as to leave one with each patient whose case necessitates frequent observation. In private practice, amongst the well-to-do classes, it will not in general be difficult to interest them in the usefulness of the thermometer; and doubtless the time will soon come when intelligent patients will recognize the value of such observations.

4. A regularly continuous observation of the range of temperature daily throughout the whole course of a disease, when fever is present. It furnishes the most important indications regarding febrile affections; and the full practical worth of the thermometer can only be learned by those who will make regular daily observations throughout the whole course of a disease. For most cases in private practice an observation made twice a-day may suffice. The observations ought-always, however, to be made at the same hours daily, namely, between *seven* and *nine* in the morning, and between *five* and *seven* in the evening,—these being the periods best adapted for the observation.

* Oswald Hornn, Leyser, und Hegershoff, in Leipsic, furnish good small instruments, ranging from 3s. to 5s. each; and Otto Autenrith, in Ulm, furnishes similar instruments for 2s. 4d. a-piece and upwards. Mr. Griffin, of 119 Bunhill Row, imports them and keeps them, or similar instruments, in stock.

5. In the less important cases the physician may make at least one observation daily himself, and leave the other to the friends of the patient or the nurse, if either of them are sufficiently intelligent. This arrangement, however, is only justifiable so long as the observations correspond with those typical of the particular disease, and so long as they are in harmony with the other general signs of its course; but as soon as notable deviations from these conditions are observed, the physician ought to make the observations for himself. A difference of one-tenth R. = 1° Fahr., or of two-tenths R. = 2° Fahr., is not of any practical importance unless it is persistent.

6. In prolonged and severe cases an examination of the records of temperature made during the course of the disease will recall to mind the nature of the case more effectively than the most detailed written history. For this purpose it is desirable to exhibit on paper the daily thermometric changes, in the form of an angular line or a curve, and to note in the proper places short memoranda of the more important incidents, or therapeutic events, which have taken place during the progress of the disease; a second and third line may be added, illustrative of the changes in the pulse and the respiration.

7. In chronic cases, when febrile attacks and their concomitant dangers may be expected, as well as in acute cases, after return of the normal blood heat, *one* daily observation will be found sufficient. This single observation may be best made in the afternoon, or at that hour of the day in which generally some apparent change takes place.

8. It is advisable to induce nurses, friends, or other attendants on the sick (whenever they seem apt pupils) to make notes of any considerable excitement or restlessness, hot hands, increased heat of head, and to consult at once the thermometer, were it but to convince themselves of being deceived, and perhaps tranquillize the patient and his friends when the instrument does not indicate any material increase of heat; but the sudden appearance of any considerable increase of temperature would always be (as we have seen) a fact of vital importance.

9. The mercurial bulb of the instrument ought to be introduced horizontally, below the fold of skin covering the edge of the *pectoralis major muscle*, and so kept in close contact with the skin of the *axilla*, completely and firmly surrounded by the soft parts.

This requires special care in the cases of very old or very thin persons. The bulb of the thermometer should be pushed up completely into the axilla; and on reading off the result, the head of the observer and the instrument must be so arranged that the axis of vision shall fall perpendicularly on the column of mercury in the tube. If the instrument does not rest completely within the axilla, or if part of it should project from the axilla posteriorly, or if its position has been in any way changed, the temperature may appear as much as 5° R. or 1° R. = 1° Fahr. or 2° Fahr. too low. It has been recommended by some to place the thermometer under the tongue, as the best place. On the contrary, the cavity of the mouth is the worst place in which the thermometer can be put, because the temperature there is continually varying according to the quantity and temperature of the air used in respiration; and if the atmosphere is cold, and deep inspirations are made, large differences may be observed, compared with the temperature in the axilla. Therefore it is necessary not to trust to observations made with the thermometer in the mouth.

10. If a sensitive thermometer be well introduced into the axilla, and if there be an actual increase of temperature, the column of mercury will rise, *within the first minute*, beyond the normal blood heat; and it will indicate, *after about five minutes*, very nearly the exact degree and temperature under the axilla. In cases which do not require the most rigorous and extreme accuracy (as cases observed for the sake of scientific information require), *five to six minutes* is found quite sufficient in private practice for the application of the thermometer. The simplest and most convenient way is to heat the instrument before inserting it into the patient's axilla, just as the surgeon heats the catheter before he introduces it into the urethra. This may be done by holding the thermometer in the warm hand, or into water heated to a temperature of nearly 30° R. = $99^{\circ}5$ Fahr.: and, after the instrument is properly placed, be satisfied if *two observations at intervals of one to two minutes give exactly the same result*. The rapidity with which the mercurial column rises depends on the degree of temperature present; and it requires but little experience to conclude, from the slowness or rapidity of the rise of the mercury after half a minute, the approximate ultimate degree of heat.

The student or physician who continues to disregard the aid of thermometry in the diagnosis of febrile diseases may be

compared to the blind man guiding himself. By means of great practice and intelligence, the blind man will often proceed rightly; but the advantages of being able to see clearly are proverbially above all price. The necessity of the use of the instrument also will soon become known to the general public, and patients will become dissatisfied if all known means of investigation are not employed in appreciating the nature of their malady. For many years the German student and physician has been familiar with its use; but, with the exception of Dr. Parkes and the pupils he taught when clinical professor in University College Hospital, the usefulness of the thermometer in recognizing febrile diseases does not seem to have been hitherto sufficiently appreciated in the medical schools of this country.

SECTION II.—INFLAMMATION.

Definition.—*A complex morbid process characterized,—(1.) By a suspension of the concurrent exercise of function among the minute elements of the tissue involved; (2.) By stagnation of the blood and abnormal adhesiveness of the blood discs in the capillary vessels contiguous to the tissue-elements whose functions are suspended; (3.) By contraction of the minute arteries leading to the capillaries of the affected part, with subsequent dilatation and paralysis of the contractile tissue of the affected blood-vessels. The nutritive changes between the blood and the minute component elements of the affected tissue become visibly altered, and although an appreciable exudation does not necessarily follow, yet a constant tendency betrays itself to the occurrence of an interstitial exudation, but which, under proper regimen and proper remedies, is often abortive. When an exudation follows as a result of the inflammatory state, it is apt to be associated with an unhealthy condition of the blood, and of the blood plasma, and to be associated with varied forms of new growth, according to,—(1.) The elementary structure in which it occurs; (2.) The special zymotic, constitutional, or local disease with which this complex morbid process may co-exist; and (3.) According to the progress of the inflammation, the amount and suddenness of the effusion, the extent of tissue involved, the diminished vascularity, and the powers of absorption of the surrounding parts.*

Pathology.—As it is not possible clearly to define the limits of

natural processes, it is not possible to give a correct definition of inflammation. It is a process the most important of all morbid states, and a knowledge of its phenomena, the laws which regulate its course, and the relations which its several events bear to each other, have been always considered as "the keystone to medical and surgical science," and the "pivot upon which the medical philosophy of the time has revolved."

It is not wonderful, therefore, that much has been written on this subject, more especially since microscopic research has been brought to aid in the investigation. Among the many who have investigated this morbid process with success, and by whose original observations its study may be said to have begun, may be mentioned Wilson Philips, John Thomson, Gendrin, Kaltenbrunner, Gerber, and Muller; and more recently the names of Alison, Lebert, Gulliver, Addison, C. J. B. Williams, Bennett, Wharton Jones, Henle, Virchow, Paget, John Simon, and Joseph Lister, are well known. From the records of these observers the following statements are compiled:—

The early experiments which illustrate the nature and phenomena of inflammation have been made chiefly on the web of the frog's foot, as well as on the folds of the frog's mesentery; and the phenomena are found to correspond in all essential points with the results of experiments performed on the more or less transparent parts of warm-blooded animals, such, for example, as the wings and ears of bats; the ears of rabbits; the mesenteries of these animals; and the brains of rabbits and of pigeons. As a general result of such experiments and observations, it may be stated that the chief constituents of the inflammation-process are to be found in altered conditions of the healthy nutritive changes—the phenomena of the abnormal state becoming more or less obvious by the redness, swelling, heat, pain, impairment of function on a large scale, and sometimes exudation in the part affected.

Phenomena and Theory of the Inflammatory Process.—The process is one in which many stages of morbid action are passed through, and which reaches its acmé when the serum of the blood and the *liquor sanguinis* transude through the walls of the blood-vessels of the inflamed part, without rupture, into the surrounding texture. This has been termed "exudation."

The series of complex changes through which the inflammatory process is seen to proceed, as observed in the transparent parts of

animals under the microscope, are found to occur nearly in the following order:—1st. The beautiful experiments and observations of Mr. Joseph Lister, Professor of Surgery in the University of Glasgow, clearly prove that a suspension of the concurrent exercise of function among the minute elements of the tissue involved is the primary lesion in the congestion of inflammation, and which immediately leads to—2d. Inflammatory derangement of the blood, which, in the vicinity of the impaired tissue-elements, tends to assume the same characters as blood always assumes when it is in contact with ordinary solid matter, and which renders it unfit for transmission through the blood-vessels. But a return of the tissue-elements to their usually active state will be associated with a restoration of the blood to the healthy characters which adapt it for circulation (*Royal Society, June 18, 1857*). 3d. The arteries of the affected part are narrowed, and the blood flows through them with greater rapidity. 4th. The same vessels subsequently become enlarged, and the current of blood is slower, although uniform. 5th. The flow of blood becomes irregular. 6th. All motion of the blood ultimately ceases, and complete stagnation ensues. 7th, and lastly, The liquor sanguinis may be exuded through the walls of the blood-vessels, sometimes accompanied by the extravasation of blood corpuscles, owing to rupture of the capillaries.

These different phenomena are associated with the production of the more obvious symptoms, namely, redness, pain, heat, and swelling. But although these changes are here mentioned consecutively, it is not to be understood that in every instance of inflammation such changes can be traced in distinct succession. The changes are to be studied as *nearly concurrent*, rather than as a distinct *series of events*, of which each stands in the relation of a consequent to one or more of its antecedents; so that, starting from impaired function of the elements of tissue to stagnation of blood in the capillary vessels, we must observe the various stages in the process almost as concurrent phenomena, which, for the purposes of study, are here enumerated in sequence.

An analysis of these concurrent phenomena has shown that the conditions for the healthy nutrition of the part are materially changed, the conditions being somewhat as follows:—

I. The supply of blood to the part is altered,—(1.) By the

changes in the blood-vessels, especially the narrowing of the arteries and subsequent enlargement of the capillaries; (2.) By the mode in which the blood moves through them.

The narrowing of the arteries, in the first instance, may be demonstrated under the microscope, by the application of warm water simply to the web of the frog's foot; and the same phenomena are presumed to occur in man, for the following reasons:—Sudden operations of the mind and the application of cold produce paleness of the skin—an effect which can only arise from contraction of the minute arteries, and the diminution of the quantity of blood thereby conveyed by them. The subsequent enlargement of the capillaries is presumed to be a constant event in the inflammation of a part. It usually extends to some distance around what may be considered as the chief seat, centre, or focus of diseased action, and in some textures the enlargement and reddening is confined to the vascular parts in the vicinity. To this condition of the blood and blood-vessels is to be ascribed the usually first observable symptom of inflammation in a part, namely, the redness. But there are also many circumstances under which inflammation has existed, and yet no redness is apparent in the part itself. Thus, we often open the body of a patient that has died of phthisis, and find the intestine ulcerated; but so far from being redder, it is paler than natural, and so far from being thickened, it is thinner than usual. We often find the cartilages of the joints ulcerated, and yet not a trace of a red vessel. In cases of bronchitis, with purulent expectoration, if the lungs be washed so as to remove the morbid product, the most experienced anatomist may be unable to determine whether the parts are in a state of health or disease. Take the arterial system, and how often do we find the aorta thickened and thinned, softened and indurated, ulcerated and its elasticity entirely destroyed, and yet not a red vessel to be seen; and when the patient has neither complained of the slightest sensation of pain, nor of any feeling of heat in the part during life? A large abscess also may form in the brain or areolar tissue, or pus may be effused into the cavity of the abdomen, without any appearance of redness, or even evidence of having been preceded by any suffering. Although in certain parts, however, as the cornea and the articular cartilages, the ulcerated intestine or the bronchi, the arterial tissues, and the seats of abscesses, the previous exis-

tence of inflammatory action is obvious from the effects produced, and where no blood-vessels existed obvious to the eye, assisted or not by the microscope, yet it is for the most part found that enlargement of the blood-vessels of the adjacent parts, and especially of those from which the diseased part derives its nutrient supply, is a constant phenomenon, purely functional, and which appears to be developed indirectly through the medium of the nervous system. In inflammation of the cornea, for instance, the blood-vessels of the sclerotic and conjunctivæ are enlarged. In ulceration of the articular cartilages, the surrounding synovial membrane and the articular extremities of the bones are more fully pervaded with enlarged blood-vessels. The vasa vasorum of the aorta round the morbidly thickened part are also the subject of enlargement, and the channel of increased supply of blood. There is, therefore, no doubt that the conditions favourable to the existence of redness are always present to a greater or less degree at the early period of inflammation; and whether the redness be always present or only slightly perceptible, the same impairment of function among the minute elements of the tissue, and increased adhesiveness of the blood discs, take part in the development of the inflammatory process.

The enlargement of the blood-vessels varies. It may be hardly perceptible, or it may increase their diameter to two or three times their natural size. Dr. Hunter established this stage of the inflammatory process in the ear of a rabbit by thawing it after it had been frozen: the rabbit was killed during the process, and the head being injected, the two ears were removed and dried. Woodcuts representing the comparative conditions of the two ears may be seen in the first volume of Paget's *Surgical Pathology*, page 295. The blood-vessels of the inflamed ear became greatly larger than those of the healthy one, and it was found that arteries before invisible, in the healthy state of the rabbit's ear, were brought clearly into view during the stage of the inflammatory process.

The redness of an inflamed part is of various intensity and shade, according to the degree of the inflammation, its stage, and the structure of the part affected. Its shades pass from a light rose colour to a deep crimson, or even purple. It assumes the form of points where congeries of minute blood-vessels are concerned; or streaks, as where the vessels of fibrous structures are

inflamed, as in tendon; or a series of minute and fine ramifications, as in synovial structures; and generally it may be stated that the form of the redness derives its character from the normal arrangement of the capillaries of the part. The redness is most intense towards the centre of diseased action, gradually softening down towards the circumference where the conditions of health exist. This gradual shading off serves to distinguish the redness of inflammation from the redness of extravasation. The margin of an extravasation is defined, its redness cannot be removed by pressure; while the disappearance of inflammatory redness under pressure is, to a certain extent, a measure of the activity of the circulation in the part. The brighter hues generally attend ordinary active inflammation—the darker hues of inflammatory action are generally associated with some specific cause of disease, a feeble action of the parts, or a tendency to gangrene. The increased depth of colour is mainly due, in the first instance, to the congestion and stagnation of blood in the existing vessels, and not in any measure to the formation of new ones. The redness, however, always appears more than proportionate to the enlargement of the blood-vessels; and we find that the red corpuscles are intensely adherent in the enlarged capillaries.

The dilated vessels of an inflamed part appear crammed with red corpuscles, which lie or move as if no fluid intervened between them, or as if they were imbedded in a hyaline substance due to the solidification of the fibrine of the liquor sanguinis. An increase of redness is also sometimes seen to depend upon extravasation of blood, or the effusion of the colouring matter of the blood corpuscles, as well into the spaces between the blood corpuscles as into the adjacent tissue through the walls of the blood-vessels. Lastly, the redness is sometimes intensified (as HUNTER first suggested, and microscopic examination subsequently proved) by the passage of the blood, unchanged, from the arteries into the veins. No new formation of blood-vessels is necessarily concerned in the redness of inflamed parts. It is only when inflammation has subsided that new vessels are formed, and pass into any new growth of tissue which may have arisen, as if for its nutrition, development, and continued growth, or to effect its subsequent removal, degeneration, decay, or absorption.

Peculiar changes of shape are also associated with enlargement of the blood-vessels, consisting chiefly of tortuosity of distribution

and aneurismal or varicose dilatation. The aneurismal or varicose state is seen to take place most frequently in the soft textures, as in the brain, where it is a frequent condition of the inflammatory red softening (KÖLLIKER and HASSE); and in subcutaneous tissue (LEBERT) the points of what appears to be extravasated blood are aneurismal dilatations of capillary vessels filled with the red corpuscles.

These varied conditions of the blood-vessels affect the motion of the fluid in the part, and consequently the supply of blood for the purposes of nutrition. Generally it may be stated that there is stagnation of the blood in the focus or centre of severe inflammation; and this stagnation is surrounded by a state of fullness of vessels and slow movement of the blood, while around and more distant still, there is fullness of the vessels with a rapid movement of the blood. From the discrepancy existing among observers regarding the statement as to whether the motion of the blood is slower or quicker when the vessels are contracted or dilated, there is evidence that the contraction alone of a vessel, or its dilatation alone, is not always sufficient to cause the current of blood to be either slow or quick. Other conditions are at work which contribute in no small degree to accelerate or slow the rate of movement in the vessels. Besides the force of the heart's action, there is a mutual relation which subsists between the blood and blood-vessels and surrounding tissue which materially influences the motion of the blood. In the healthy body this mutual functional relation between the minute elements of tissue and the blood is necessary to maintain it in a state fit for transmission through the vessels. The mere contraction of the arteries leading to a part does not tend to stagnation of the blood in the capillaries of the inflamed part; on the contrary, the movement onwards of the blood in the vessels is influenced or modified by the vital functional processes going on between the capillary vessels and the surrounding elements of tissue, and which has been variously named the "capillary force," the "vital force," the "nutritive force:" it is also mainly influenced by the action of the heart itself, and by the physical condition of the vascular tubes through which it has to pass. Accordingly, at first, with contraction of vessels, the current has been described as being quickened. It also sometimes slackens, or even retrogrades for a time, and not unfrequently oscillatory movements may be noticed. But when dilata-

tion is complete, the blood flows with rapidity, and a greater quantity passes during a given time than in the unexcited state of the parts. This is known as the state of "determination of blood to a part," or "active congestion." The natural function of the part thus becomes simply exalted; and it may be said that a step beyond this will pass the confines of that neutral ground which exists between health and disease. With an increased circulation, and such "determination of blood to a part," functional activity is not only maintained, but is promoted and increased; and unusual transudation of the nutrient material may take place, chiefly of the serum of the blood. Hence the œdema which surrounds an inflamed part. After a time the motion of the blood becomes slower, while the volume propelled is increased, and the retardation gradually increases till the blood corpuscles are no longer propelled, floating in their *liquor sanguinis*, but accumulating in masses, they advance by a jerking intermittent motion, till at last complete stagnation takes place. The blood corpuscles now detained exhibit a marked tendency to adhere alike to the walls of the vessels and to each other; thus accumulating together and sticking in the capillaries, while the *liquor sanguinis* flows onwards. To this condition the term "stasis" has been applied. In the immediate neighbourhood, and surrounding the part which is in the condition of *stasis*, the circulation of the blood goes on with increased rapidity; it may even pulsate in the arteries and oscillate in the veins, while it moves with a uniform but rapid flow through highly distended but less turgid vessels. When these conditions exist simultaneously, and the true morbid process is completely established, the capillary vessels may burst, causing hæmorrhage or extravasation into the surrounding tissue, or the serum and *liquor sanguinis* may transude through their walls, without rupture, into the surrounding texture.

The "determination of blood to a part" here noticed, characterized by dilatation of the arteries with increased flow of blood through the capillaries, must be distinguished from the "congestion of inflammation," characterized by the accumulation and stagnation of red and white corpuscles in the vessels, tending to be abnormally adherent to each other and to the vessels. Both of these phenomena, namely, "determination" and "congestion," may result from irritation. The dilatation of the arteries seems to be immediately developed through the medium of the nervous system,

while the accumulation of the blood-discs and stagnation of the blood is the immediate and direct result of impaired or suspended function of the minute tissue-elements contiguous to the capillary vessels.

The "determination of blood" and dilatation of the arteries lead to no change in the quality of the blood itself; on the other hand, accumulation and stagnation of blood, in the congestion of an inflamed part, are associated with increased adhesiveness of the red and white discs. Mere determination of blood becomes obliterated after death by the *post-mortem* contraction of the arteries, whereas the congestion of inflammation is persistent. It is an evidence of organic lesion declaring itself as distinctly in the dead as in the living; and thus the most important, if not the only sign of the early stage of inflammation having occurred during life is recognizable, on dissection, by the intense redness due to the accumulation of red discs adherent to each other in the minutest ramifications of the vessels, and not due to distention of the vessels merely.

Such is a statement of the facts ascertained regarding the early phenomena of the inflammatory process; and they are of such a kind that, with the facilities of study which ought now to be within the reach of every student of medicine, he ought to make such experiments as have been already noticed, or see them made by others, and thus really appreciate the steps of that morbid process which he requires to treat so extensively in practice, and of which he can form but a faint conception from the most lucid description.

II. The constitution of the blood is altered as regards its adaptability to nourish the part.

The nature of this alteration cannot be chemically expressed; but microscopical observation has established a fundamental fact, namely, that the tissues through which the blood flows have such special relations to the living fluid, that, in the healthy state, the functional activity of the minute tissue-elements maintains the blood in a state fit for transmission through the blood-vessels; and the first change observed in the blood, subsequent to any impairment of function of tissue-elements, is an increase of adhesiveness of the red as well as of the white corpuscles; but the white corpuscles are now known to be susceptible of much greater adhesiveness than the red; so that slight irritation, leading to

impairment of function, causes stagnation of the white sooner than of the red discs. The blood is not thus altered in the first instance throughout its whole mass; but the change is a local one, confined to the seat of the inflammatory process. At one time it was believed that the blood was altered in its constitution chiefly by an increase of the fibrine and the white corpuscles;* but it is now found that the white or rudimental corpuscles of the blood cannot be separated from the fibrine by any known process; consequently the relative amount of fibrine cannot be correctly stated in relation to the blood. And, as in many inflammations these corpuscles are increased, as well as in many conditions, such as pregnancy, in which no inflammatory process exists, the blood is similarly altered, it is not known how much of change is due to fibrine or how much to the white corpuscles. The generation and accumulation of large numbers of white corpuscles in the vessels of an inflamed part is not now received as a fact. The phenomenon may be true as regards some frogs, but not as regards warm-blooded animals; and it is consistent with the experience of three most eminent pathologists, who have experimentally examined this subject—namely, Mr. Wharton Jones, Dr. Hughes Bennett, and Mr. Paget—that an especial abundance of white corpuscles in the vessels of an inflamed part is neither a constant nor even a frequent occurrence. Dr. Hughes Bennett's recent researches relative to leucocythæmia have also shown that even the most extreme abundance of white corpuscles in the blood has no tendency either to produce or to aggravate inflammations.

A remarkable phenomenon presented by the red blood corpuscles in inflammation was first observed in 1827 by Mr. Lister, sen., and by Dr. Hodgkin, and afterwards accurately described by Mr. Wharton Jones.

They observed that when healthy blood is received on a glass plate, or the clean surface of a polished lancet, and immediately examined, the corpuscles lie diffused in the *liquor sanguinis*, but in about half a minute they run together into piles or rouleaux, which arrange themselves in small meshed networks. But if a

* Andral and Gavarret showed that the proportion of fibrine in the blood was augmented in inflammations, when sufficiently severe or extensive to affect the system. In health the average proportion is three parts in 1,000, and in cases of severe inflammations it has been found to rise as high as eight, nine, or ten parts in 1,000. This increase commences as soon as the inflammation is established, and ceases when the process begins to decline.

drop of blood from a patient with acute rheumatism, or with an inflammation, be similarly examined, piles of red corpuscles instantly form, and are clustered into masses, leaving a network with wide interspaces.

This appearance of itself, however, is not a sure sign of inflammation. It may be observed in the blood of the chlorotic female as well as in the pregnant one; in those also in whom a plethoric condition as regards the blood exists; in persons in health whose circulation has been much accelerated, as by violent exercise; and it appears to be the natural state of the blood of horses. It is a phenomenon resulting from an increased tendency to aggregation of the blood corpuscles, and gives a granular appearance to a thin layer of blood when viewed with the naked eye. When blood is drawn off in quantity, the phenomenon is associated with the formation of what is termed the "buffy coat," as the clustered blood corpuscles, rapidly sinking, subside to some distance below the surface before the fibrine and the white corpuscles begin to coagulate.

However indefinite and uncertain the changes may be, as observed upon a small portion of the blood, it cannot be doubted that the blood, stagnant or retarded in an inflamed part, undergoes important alterations; and by a constant succession of such changes the whole fluid may come at length to be materially altered, as indicated by the general effects and constitutional disturbance, extending throughout the nervous and the vascular system, and which may ensue in the train of an inflammation of purely local origin. It is probable that local changes ensue in the blood similar to those we shall have to notice as taking place in the products of growth in and amongst the elements of tissue during the inflammatory process. There is no doubt, as Wharton Jones has shown, that fibrinous coagula occasionally form and even degenerate within the blood-vessels. When also the stagnation of the blood is not constant, these fibrinous coagula are carried away into the general circulation, giving rise to the phenomena of embolism (to be afterwards described) in the capillary vessels of some of the more solid viscera, such as the brain, lungs, liver, spleen, or kidneys, and by their degeneration may infect the whole mass of blood, excite constitutional disturbance, producing sometimes various and wide-spreading suppuration,—as when purulent infection is consequent on local injury, or when a blood

clot passes upwards, and becoming lodged in the cerebral vessels, induces the state known as softening of the brain.

There are many points or questions deserving of attention regarding the theory of the inflammatory process; but it is also obvious that in a handbook such as this, any mere analysis of speculative doctrines ought not to take up much space. The following statement will therefore merely embrace as much as possible of those topics of special interest, which a more extended and accurate physiological knowledge of the process of inflammation has shown to be the proper objects of more extended inquiry.

In the first place, as to the primary seat of the inflammatory process, there can be little doubt, from the phenomena already described, as well as from the results of dissection, which show the progress and effects of the process, and from the experimental researches of Hunter, Thomson, Wilson Philips, Hughes Bennett, Wharton Jones, John Simon, Paget, Lister, and other observers, that the vital morbid process known as "inflammation" is connected with the minute capillaries, and the most minute elements of tissues which they nourish. Questions relative to the theory of the process are therefore found to be intimately connected with the histological and physiological relations of these parts.

During the earliest period of the process—the period of increment, or of incubation, as it has been termed—it appears to be the inherent properties of the minute component elements of tissues which first undergo a change, and, combined with the reflex actions of the nervous system, seem to maintain, to promote, or to increase the activity of the subsequent stages.

The simplest effects upon the minute elements of tissue, and upon the blood-vessels, are seen to follow the application of the mildest or slightest physical or chemical agents, but which, operating powerfully, are also capable of extinguishing altogether the life of the constituents of the body. When the action induced is mild and gentle, the tissues become incapable of performing their wonted functions; and, provided the mechanical or chemical agency has not been too severe, the impairment of function may subside, and the tissues will return to their normal state of functional activity. This is "Resolution" of the inflammation.

Such irritant causes acting either immediately from without, or through the blood, or through the instrumentality of the

nerves, each component texture of the part becomes affected as soon as it is brought in contact with the irritant. A gradual contraction of the arteries takes place—the contraction following at some interval after the application of the stimulus—is slowly accomplished, and persists for a variable length of time. Relaxation then no less gradually ensues, when the capillaries open up and slowly dilate till they acquire a size larger than they had previous to the application of the stimulus.

The minute arteries have been shown by the histologist to possess in abundance the structural elements of the non-striated contractile tissue; and in this respect they closely resemble the constitution of the muscular fibre of the intestine. Accordingly, the contractions they undergo have been considered as analogous to *spasms* (as Cullen first suggested); while the succeeding dilatation may be of the nature of *relaxation*, and ultimately of *paralysis*. This paralyzed state is shown from the fact that the same vessels now dilated will not contract upon a re-application of the same stimulus which before made them contract. If the stimulus is made with a needle upon the vessels in the transparent parts of an animal, the needle may be repeatedly drawn over such dilated vessels and no contraction will follow; but with a stronger stimulus, such as that of heat, they may be made to contract again, and even close; and this state of contraction may persist for a whole day, before the vessels again open up and permit the blood to flow (PAGET.) On the other hand, the true capillaries seem totally destitute of any structure known to be contractile. They merely consist of a delicate homogeneous membrane, beset with occasional nuclei. A film of collodion is not more homogeneous nor more continuous than the membrane of a capillary (VIRCHOW). Whereas the minute arteries (some of them less even in calibre than capillaries) possess distinct coats, one of them consisting of a single layer of muscular (or contractile) fibre cells, wound spirally round the internal membrane of the blood-vessel, so as to encircle it from one and a half to two and a half times. The arteries, to their smallest branches, are sometimes contracted to absolute closure, and at other times are widely dilated; whereas the capillaries are never entirely closed, nor do they present any variations in diameter which are not due to the elasticity of their parietes (LISTER, l. c.)

The most interesting point in the whole process is perhaps

that which embraces an inquiry into the cause of the "stasis," or stoppage of the blood, and the exudation of the *liquor sanguinis*, which are the most difficult phenomena to explain consistently with physiology. This is a point which I think the observations of Professor Lister have so very beautifully illustrated; but the explanations of other eminent pathologists and experimentalists, if not universally satisfactory, serve to present the subject in a variety of aspects to the mind, which cannot fail to be both interesting and practically instructive. Henle, Simon, Bennett, Williams, Rokitansky, and Paget have all helped to elucidate the process by the following theories.

The theory of Henle, or as it is sometimes called, the "neuro-pathological theory," assumes that the stimulus, acting on the sensory nerves of the part, excites in them a state which, being communicated to the spinal nervous centre, is reflected on the vascular nerves, occasions their paralysis, and therewith paralysis also of the contractile coat of the blood-vessels. Various modifications have been made upon this theory; but as the phenomena have been seen to take place in the case of absence of a spinal cord, and in division of the roots of the nerves, and in section of the lumbar and sciatic nerves, such facts are subversive of the hypothesis. Henle considers the stasis as a necessary physical consequence of this dilatation of the blood-vessels, and this stasis, together with the relaxed and dilated state of the vessels, favours the exudation of serum, the consequence of which is, that the plasma of the blood in the part becomes inspissated by a preponderance of albuminoid matter over the salts. This inspissation of the plasma determines endosmotic changes in the red corpuscles, in consequence of which they are disposed to aggregate.

Simon propounds the view that the phenomena are due, not to a reflex action, but to a direct change effected by the living molecular structure of the part on the blood which traverses it, or on the vessels which convey that blood.

Bennett ascribes the change as due to a vital force actively operating through the tissues which lie outside the vessels, and which is the only active agency causing the approach of the coloured particles to the capillary walls of the blood-vessels, and the passage through them of exudation.

Paget supposes a mutual relation to exist between the blood, its vessels, and the parts around, which being natural, permits the

most easy transit of the blood, but being disturbed, increases the hindrances to its passage.

Dr. J. C. B. Williams considers that an essential part of inflammation is the production of numerous white globules in the inflamed vessels, and that the obstruction of these vessels is mainly due to the adhesive properties of these globules.

Rokitansky is of opinion that the condition of *stasis* proceeds,—1st. From the sticking together of the blood corpuscles, the heaping up and wedging of them in the capillaries, while the plasma in part flows off towards the veins; 2d. From the inspissation of the plasma, occasioned by the exudation of serum through the dilated and attenuated walls of the vessels, and its saturation with fibrine and albumen; 3d. From the heaping up of the colourless corpuscles, *i.e.*, the nucleus and cell formations, together with blood globules; from their sticking together, and from the delicate hyaline, fibrinous coagula which develop themselves among them. Rokitansky considers this to be the most important moment in the inflammatory process, since on the one hand it very specially throws light upon the phenomena of *stasis*, and on the other hand it comprehends the plastic processes which take place in the heaped up and stagnant blood. It separates in this way the process of inflammation from a merely simple one of exudation. The elementary formations above-mentioned are not merely swept together towards the place of *stasis*, but they originate as new formations in the stagnant blood, which generally presents remarkable alterations.

Wharton Jones describes the progress of *stasis* as consisting,—1st. Of the adhesion of collapsed and dark-red blood corpuscles to the walls of the vessels; and 2dly. The adhesion of other blood cells to these. The first adhesion of the blood cells usually takes place at a bifurcation, and the stagnation of blood is seen to begin in those capillaries which are least in the direct course from the artery to the vein, depending in a great measure upon the inspissation of the plasma, or its increased quantity of fibrine and albumen.

Whatever explanation may be given or accepted as to how the phenomena of inflammation in a part are brought about, our views regarding the essential nature of the process have been hitherto modified according as this complex morbid state has been studied by its effects as seen on the dead rather than on the living body.

There are some especially eminent pathologists whose combined observations have of late done much to convey a clear notion of the essential nature of this complex process, namely, Alison, Virchow, Bennett, Simon, Goodsir, Redfern, and Lister. While Dr. Bennett regards an exudation from the blood-vessels as the necessary constituent of inflammation, Alison and Virchow, on the other hand, recognize the morphological changes of the living tissues, such as have been described in inflammation, as betraying merely a *tendency* in a part to such a local change as exudation amongst its structure. That *local tendency* may be so slight that hardly any difference can be appreciated between the healthy changes attendant on normal nutrition, and those changes between the blood and the minute tissues which are of such a kind that a morbid change (inflammation) is established in the elementary components of the tissues themselves, without any appreciable exudation having taken place, either amongst the interstices or upon the free surfaces of membranes. To such a condition Virchow gives the name of *parenchymatous inflammation*, meaning thereby that it is a process established locally between the capillaries, the blood, and the component elements of tissue, and expressed by a tendency merely to the effusion from the blood-vessels of such plastic material as may eventually take place.

Inflammation may thus exist as a local morbid process, characterized by an abnormal condition of the nutritive changes between the capillaries, the blood, and the component parts of a texture, without any appreciable exudation. Such an abnormal condition will, under proper regimen and proper remedies, in a case of simple inflammation, seen from the first, completely subside, no interstitial exudation ever taking place.

Examples of this simple form of inflammation have been fully illustrated by Goodsir and Redfern in this country, by their demonstrations of what takes place within the large cells of cartilage. The cells become larger, the number of nuclei increases, and some, or all of them, may undergo fatty metamorphosis under the influence of this the simplest form of inflammation, and which is only manifested by this abnormal nutritive process between the blood and the cells, and which at once leads to these changes *within* the cell elements of tissue, described by Virchow as a "cloudy swelling" of these parts, *e. g.*, the cells of the urin-

iferous tubes, and those of the mucous membrane in the state of catarrh. In this abnormal nutritive process, however, there is a constant tendency to the interstitial exudation of a hyaline material, which may become fibrous or filamentous, and ultimately soft and gelatinous. Virchow, Weber of Bonn, and His have demonstrated similar changes in the cells of the cornea.

Thus the minute and penetrating observations of Virchow have given a more comprehensive meaning to the process of exudation than it has hitherto, in this country, been understood to signify; and such alterations as he and others have described in the elements of the tissues of an inflamed part have been in a great measure overlooked, except by Dr. Alison and Mr. Simon. The latter especially states that the irritation of the inflammatory process is independent of the nervous influence, *but is a direct change operated by the living molecular structure of the part on the blood which traverses it, or on the vessels which convey that blood.* Dr. Alison, also, long ago recognized the *tendency* to interstitial exudation as attending such vital changes in the constituent elements of a part, and which entitled it to be considered inflamed. The accurate observations of Virchow, Goodsir, and Redfern have shown that such primitive changes do take place before those more palpable phenomena occur which constitute the exudation as described by Bennett, namely, the exudation of decolorized lymph into the interstices between the constituent elements of a texture. Both sets of phenomena alike show that *inflammation is only one of the various shades of deviation from the normal process of nutrition:—a diseased action tending to a local lesion.* (*British and Foreign Medico-Chirurgical Review*, January. 1854.) That the irritation of inflammation is in some measure independent of the nerves, the following interesting experiment related and performed by Mr. Simon may be quoted in proof:—

“ A patient had complete anæsthesia of the fifth nerve, dependent (as a *post-mortem* examination subsequently showed) on its organic disease; the conjunctiva, as well as the integument of the face, was utterly insensible; not only was the function of the nerve destroyed, but those reflected nutritive changes of which I have already spoken had taken place, and had exhausted themselves; showing that the nerve was spoiled for participation in the acts of nutrition (whatever they may be) no less than for its more obvious uses as a medium of conscious sensation; the cornea had undergone ulceration, and had healed again. The following

experiment was carefully made:—The lids being held open, a single granule of cayenne pepper was laid upon the insensible conjunctiva; in a few moments it had become the centre of a very distinct circle of increased vascularity, the redness of which slowly became more and more distinct as long as the stimulus was suffered to remain, so that, on its removal, there was a very evident circumscribed erythema on the surface of the membrane. I consider myself justified in believing that this change occurred without any intermediate nervous excitement; not only because the history of the case would lead me to consider the fifth as annihilated; not only because the experiment was totally unattended with sensation; but likewise because there was the very remarkable absence of that sympathetic phenomenon which the faintest remnant of nervous excitability would have produced—namely, there was not the slightest trace of lachrymation." (*Lectures on General Pathology*, p. 76.)

Further evidence might be submitted from the papers of Mr. Joseph Lister to the Royal Society, already referred to.

Such being the essential nature of inflammation, it is easy to understand how reasonable is that doctrine which teaches "that the process of inflammation is susceptible, at all times and in all countries, of very great variety as to extent or intensity, and especially as to the constitutional affection associated with it or consequent upon it."

Products, Effects, or Events of Inflammation.—Care must be taken not to put the *products* of inflammation in place of the *symptoms* of inflammation. When the local impairment of function of the minute elements of tissue in process of inflammation *is confined to a small space, or is carried on upon a minute scale, or rapidly abates*, the inflammation is said to *terminate by resolution* as a general principle; that is, the abnormal action ceases, interstitial exudation does not take place, the tendency to further impairment of function is subdued and passes off, and the part is left apparently as it was before. If, however, interstitial exudation has taken place, and *resolution* is to be effected, the return of the part to health may be followed, for some time, by some impairment of its structure and function.

After the process has thus gone a certain length, an increased local growth of cells, and their liquefaction or reduction to a state capable of absorption (what Dr. Addison calls *cell-therapeutics*), are essential to the restoration of the part. Before the process has attained such a length, however, *resolution* may be simply effected

by a gradual return of all the parts to a natural state: a mere retracing of the steps by which the natural actions had been departed from sufficiently describes the process (PAGET).

The process of *resolution* has been closely watched by Mr. Paget. He has seen, in those cases where impairment of function and actual lesion had taken place, that fragments of fibrine, washed from the blood in the vessels of the injured parts, were borne along and floated in distant vessels. The observations of Dr. Kirkes, also, leave no doubt that similar changes may occur in warm-blooded animals, and may be the source of great evils; may be, indeed, productive of some of those constitutional effects yet to be noticed, by carrying the materials of diseased or degenerate blood from a diseased organ to one that was previously healthy. When the disappearance of the inflammation is unusually sudden and rapid the event is technically called "*delitescence*," and if at the same time the symptoms of inflammation appear at another part not anatomically connected with the part first diseased, the event is called a "*metastasis*."

When the process does not confine itself to the simple expression of altered nutritive changes between the constituent tissues of a part and the blood; but when the tendency to exudation amongst the interstices of textures continues, and does not subside, as already explained,—namely, by *resolution*,—then it is that (1.) such a material is separated from the blood as will become a medium or *nidus-substance*, in which many changes connected with the growth of new particles, granules, or cell forms will take place, and the phenomena of which have been so well described by Bennett, Gluge, Paget, Virchow, Beale, and John Simon; and (2.) coincident with this exudation, and the changes which it undergoes, the tissue of the part itself sustains serious alterations. For in all such inflammations, especially of the more vascular parts, when there is increased exudation from the blood-vessels, there is a great deterioration of the surrounding elements of tissue. The texture is rendered soft and easily torn, and by such changes of cohesion the elasticity of parts (a circumstance often of very primary importance) becomes greatly altered and impaired.

These changes, therefore, Mr. Paget happily describes as consisting of,—(1.) *Productive* effects—that is, effects resulting from the growth of new particles, granules, or cell forms from pre-

existing germinal elements of tissue, and which are susceptible of further development, and also of *degeneration*; (2.) *Destructive* effects, such as *softening, degeneration, absorption, ulceration*, and *death* of tissue.

Productive Effects of Inflammation—Inflammatory Effusions or Exudations.—These consist of,—(1.) Serum; (2.) Blood; (3.) Fibrine; and (4.) Mucin. These last two are the only *true inflammatory exudations*.

(1.) *Serous Effusions, &c.*—The effusion of pure serum is said to be very rare. In inflammation of a serous membrane, as the pleura, the fluid effused is not only greater in quantity than natural, but is also greatly altered in quality. In health the serous secretions are little more than pure aqueous vapour, with a trifling addition of saline matters; but when they occur in an inflamed part, they contain a considerable quantity of albumen, sometimes a portion of fibrine, and at other times the secretion appears to be the pure *liquor sanguinis* which is effused, entirely unchanged in its physical properties. The quantity effused varies, according to the part affected, from perhaps a portion of an ounce to a few pints, or even a few gallons.

This product of inflammation, but mixed with fibrine, may be seen in the fluid contained in blisters raised by counter irritants in a healthy person; also in the fluid of *peritonitis*; of *pleurisy* and of *pericarditis*; such also is the fluid that fills the early vesicles of *herpes* and *eczema*, and other cutaneous eruptions. It is also seen in the fluid which surrounds an acute, deep inflammation beneath the skin. The fluid of a common *hydrocele* is another example of serous effusion. The phenomena associated with the production of such a secretion may be often seen surrounding a phlegmon or boil of large size. While the centre or *core* of the boil is hard, it is surrounded by textures into which the *effusion* that has taken place is *serous*. Such serum is also seen to a great extent in *pelvic cellulitis* in its first stage. A very demonstrative and interesting example of this is given by Professor Simpson, of Edinburgh, in the *Medical Times and Gazette* for 1859, p. 27. July 9. In such cases the fluid fills the areolar tissue which immediately surrounds the inflamed parts; and when the finger is pressed firmly on the part, the fluid is displaced into the adjoining areolar spaces, which yield to receive it. When the finger is withdrawn, the fluid does not immediately

return, but an impression is left in the shape of a pit. The part which is the seat of *serous* effusion is then said to *pit on pressure*, or to be *œdematous*.

The fibrine of inflammatory serous effusions remains in solution for weeks or months within the body, during life, but will coagulate readily when withdrawn. This delay of the fluid to coagulate within the body is a propitious event. So long as it is liquid, absorption may still ensue without its undergoing any ulterior change when the inflammation subsides. This subsidence of the inflammation, however, is necessary, for it is known that so long as inflammation continues there is impairment of function, and absorption does not take place.

One constant characteristic of the *productive* effects of inflammation is, that growing material is always developed from the pre-existing germinal elements of tissue; and the effusion that results from mere mechanical obstruction to the flow of blood is very different from the fibrinous effusion of an inflammation. In the former case the fluid effused from the blood is merely the serous part, and will not coagulate as the fluids of *anasarca* and *ascites*. Such fluids, as a rule, neither present fibrine, nor are any granules, particles, or cell forms developed in them from the elements of surrounding tissue.

Fibrine can only be made to exude upon any surface or part in a state of irritation or inflammation. Such a local change is sufficient to cause the exudation of fibrine, independently of obstruction to the circulation; and the cause of the greatest differences in the nature of exudations is to be found in the special constitution of the irritated parts (VIRCHOW).

It has been also clearly shown (SIMON, LEHMANN, BEALE) that there are two essential characteristics of inflammatory effusion,—(1.) It tends to contain certain ingredients in larger proportion than that in which they exist in the blood; (2.) Organic forms find in it a suitable place for growth. The great chemical characteristic of inflammatory exudations is their excess of chloride of sodium and of phosphates and albumen.

The site of effusion resulting from inflammation is important, as sometimes constituting the chief element of danger—a danger sometimes immediate, from the mechanism of the parts affected. A large quantity of fluid is often also poured out in a very short time. The cavity of the pleura may fill in a few hours, and the

lung may be compressed by it to a half or a third of its bulk: and if both pleural cavities become thus affected, constituting *double pleurisy*, the patient must die from suffocation, if not at once relieved by allowing free vent to the fluid. This operation is called *tapping* the chest, or, technically, "*paracentesis thoracis*." Serous effusion into the areolar sub-mucous tissue of the glottis may also produce almost immediate death from suffocation, unless the cavity of the larynx is immediately opened to admit the air to the lungs (WATSON).

(2.) *Blood Effusions or Extravasations*.—Such chiefly occur from rupture of the new vessels developed in the newly formed material, which has just become vascular (ROKITANSKY). In the ordinary course of internal inflammations extravasations of blood are rare, and betoken an unfavourable state of the constitution generally, such as occurs in typhous fevers, in scurvy, in purpura, or in syphilis. The *post-mortem* evidence of such extravasations is the presence of a coloured cicatrix at the spot of rupture and effusion, and the colour is found to be due to the presence of hæmatoidine, generally in the form of a mass of aggregate crystals, composed of minute rhombic columns, and which may be considered as the regular typical ultimate form into which hæmatine is converted in any part of the body where considerable masses of extravasated blood continue to lie for any length of time, *e. g.*, apoplectic clots, and coagula in the Graëfian vesicle of the ovum after menstruation (VIRCHOW).

It is interesting to observe how little colour exists in many inflammatory exudations. This is so remarkable a property with some, that the late Dr. Robert Williams attempted a classification of inflammation into what he termed "*chromatous*" and "*achromatous*" inflammations.

Mr. Paget correctly observes that we must not confound with hæmorrhages the cases in which the inflammatory products are merely blood-stained, *i. e.*, have acquired a more or less deep tinge of blood, through the oozing of some of its dissolved colouring matter. The natural colour of inflammatory new formations is greyish or yellowish white, and even when they have become vascular, their opacity in the recent state prevents their having any uniform tint of redness visible to the naked eye. When inflammatory products present the tinge of redness, it is either because of hæmorrhage into them, or because they have imbibed

the dissolved colouring matter of the blood; and when this imbibition happens during life, or soon after death, it is important, as implying a cachetic, ill-maintained condition of the blood, in which condition the colouring matter of the corpuscles becomes unnaturally soluble.

(3.) *Inflammatory Lymph or Fibrine*.—This product is so named to distinguish it from the lymph in the lymphatic vessels, with which it is probably not identical (PAGET). It is a characteristic primary product of the inflammatory process, and was called originally "*lymph*," or "*coagulable lymph*;" and more recently it has been called "*exudation*," or "*fibrinous*" or "*inflammatory exudation*." "It is at first," says Mr. Paget, "probably always a pellucid liquid exudation which passes through the blood-vessels"—"sweats through them," as Simon hath it—"and especially through the capillaries of the inflamed part. Its most characteristic general properties are, that it may become a *nidus-substance*, capable of taking some share, or of assisting in promoting the growth of new elements like the natural connective tissue of the body." But the nature of the products of this development in the "*inflammatory lymph*" varies much, according to the part and the state of the constitution; and accordingly Bennett attempts to distinguish the products of *simple exudation* from those of *tuberculous* and *cancerous* exudations. The typical elementary forms which may grow amongst inflammatory lymph vary according to a much greater variety of circumstances. The circumstances which tend to modify the type of the inflammatory process, or impart to it a particular *tendency* in respect to the nature of the productive material, may be shortly stated as follows:—

(1.) The nature of the tissue in which the inflammation takes place.

(2.) The period at which the product is examined after exudation has taken place and growth commenced.

(3.) The state of the blood and the nature of the *zymotic* or *constitutional* morbid state which may be associated with the inflammation.

(4.) The amount of vascularity which the affected part retains.

(5.) The amount of the local exudation and the extent of healthy tissue implicated.

(6.) The suddenness of the phenomena of exudation and of growth.

(7.) The persistence of the inflammatory state in its vicinity.

(8.) The amount of fluidity, serum, serous effusion, blood, or mucus, associated with the *inflammatory lymph*.

These are the chief circumstances which determine and modify the elementary forms which may grow amongst the "*inflammatory lymph*," and which may advance to farther development, or to degeneration. These circumstances, severally, or more or less collectively, influence the different stages of progression, by which the local lesion of the inflammatory process may ultimately terminate in *resolution*, in *permanent organic mischief*, in *death of the parts involved*, or in *death of the patient*.

There are several typical forms, especially found growing amongst the "*inflammatory lymph*," and in the growth of which the material of the lymph may take some share, namely, the granular, molecular, or fibrillated development of *fibrinous* products and *corpuscular* forms.

Rokitansky describes these typical forms by the terms "*fibrinous*" and "*croupous*," and Dr. C. J. B. Williams by the names of "*plastic*" and "*aplastic*." Examples of each variety may illustrate the application of the terms. To the *fibrinous* or *plastic* variety belong the serous effusions already referred to, and perhaps also the granular, molecular, or fibrillated growths. The *corpuscular*, *croupous*, or *aplastic* forms of lymph are represented by those growths which never become consolidated, as in the early formed contents of vesicles in *vaccinia* and *herpes*; in the *fluid of blisters* raised in cachectic patients; in some instances of *pneumonia*; and in some forms of inflammation of *serous membranes*. In by far the larger number of inflammatory products these typical forms are mixed in various proportions; and the larger the proportion of corpuscles in new growth, the greater is the probability of suppuration, or of some other degenerative process, and the more tardy is any process of development into tissue, such as that of adhesions, indurations, and the like. In other words, the preponderance of granules, molecules, and fibrillated material in the new growth, is generally characteristic of the "*adhesive inflammations*;" the preponderance of corpuscles, or their sole existence in a liquid medium, is a general feature of the "*suppurative inflammation*." The hardness of inflamed parts

is due to the former of these typical forms of inflammation, and is exemplified in the case of a *phlegmon* or *boil* before it suppurates; as also in a lung in a state of *hepatization* when its textures are enclosed by lymph, "just as the stones of a wall are by the cement."

On the surfaces of inflamed membranes the new growth forms a layer of a membranous firmness or consistence, to which the name of *false*, *adventitious*, or *pseudo-membrane* has been given. By this new growth the naturally opposed surfaces of parts which are inflamed are apt to adhere. This is commonly seen to be the case between such serous surfaces as the *pleura*, the *pericardium*, the *peritoneum*, or the *edges of a wound*. The inflammation associated with this organization is sometimes called "*adhesive inflammation*;" and Dr. John Thomson ascertained that this growth and organization might be effected between the surfaces of wounds in less than *four* hours after they were inflicted.

On the surfaces of mucous membranes may generally be seen the "corpuscular" typical form of new growth as a result of inflammation. It has little tendency to cohere, but grows in films, gelatinous masses, shreds, patches, or delicate casts of the surface upon which it was formed. The new growths in chronic catarrh of the intestines are an example; so are the membranes sometimes passed from the cavity of the uterus, and called *dysmenorrheal membranes*. In the "adhesive" form of inflammation the new growth of granules or of molecules may ultimately assume the form of *fibrous* tissue, interstitial to the textural elements inflamed. Examples of this organization are seen in the laminated and nodular thickening of the capsules of the spleen, the thickening and induration of the periosteum, or the capsule of the hip joint in chronic arthritis; and by virtue of the peculiar tendency to contraction which fibrinous products possess, the contractions of parts are to be explained which have been the seat of such a form of inflammation.

There are instances also in which the new growth assumes the form of adipose tissue, elastic tissue, and epithelium (KIRKES, VIRCHOW, PAGET); and bone is a very frequent ulterior change which it assumes, especially when the new growth is interstitial to fibrous tissue; but these ulterior events only happen *after* the inflammatory process has ceased in the part. So long as the

inflammatory phenomena continue, the tendency of the new growth is rather to assume the *corpuscular* than the more adhesive forms of organization. The tendency is to the formation of various corpuscular forms, as those of pus cells. Hence rapid organization accompanies, as a general rule, a minor degree of action; and by depressing the action of a part, we tend to prevent the threatened occurrence of suppuration.

The existence of the inflammatory state, associated with an interstitial exudation, influences the simplest *corpuscular* forms of organization. *Lymph cells*, or *simple primordial* forms, occur, which are represented by the corpuscles of chyle, lymph, the white corpuscles of the blood, and by those of granulations on the surface of a wound. These simple cells become developed amongst the lymph while it is still fluid, transparent, and apparently homogeneous. The first discernible organic form in the lymph of *herpes*, for example, is that of a mass of soft, colourless, or greyish-white corpuscles, about $\frac{1}{100}$ th or $\frac{1}{200}$ th of an inch in diameter, round or oval, pellucid, but appearing, as if through irregularities of its surface, dimly nebulous or wrinkled. It does not look granular, nor is it formed by an aggregation of granules; nor, in its earliest state, can any cell wall be clearly demonstrated, or any nucleus on adding water. In a few hours, however, a pellucid membrane appears to have grown over its surface, permeable by water, which raises up part of it like a clear vesicle, while the contained mass retreats or subsides to the lower part of the enclosure, and appears more nebulous or grumous than before. A nucleus ultimately forms, and can be distinguished in this mass (PAGET).

From these primordial cell forms in the lymph either the adhesive or more corpuscular forms of organization may proceed; and all the various forms of corpuscles described by authors as plastic cells, fibre cells, candate cells, or fibro-plastic cells, and some forms of filaments, are developed from the germinal matter of the surrounding tissue by continuous development. Also, from the development of the primordial granules, corpuscles, or cells, all those elementary forms proceed which are known as "*pus corpuscles*," "*granule cells*," "*compound granule masses or cells*," "*Inflammatory globules*," and much of the *molecular debris-like matter* that makes inflammatory effusions turbid.

The modes of growth as well as degeneration are well described

by Mr. Paget, from whose work on Surgical Pathology the following examples and illustrations are chiefly taken:—

(1.) The lymph may simply wither or waste, as may be noticed in the vegetations on the valves of the heart or large arteries when they become yellow, stiff, horny, elastic, and nearly transparent; or in the lymph deposited over a compressed lung, associated with empyema or hydrothorax.

(2.) The fibrine of lymph may undergo changes similar to what is known as fatty degeneration,—changes similar to those which occur in the *primordial lymph* cell, when it is transformed into pus. The two changes generally go on together. To the former change, namely, the fatty-like degeneration of the fibrine, Mr. Paget gives the name of “*liquefactive degeneration*,” the solid fibrine of inflammatory lymph that becomes again liquid when suppuration takes place, as may be observed in a hard mass of inflamed texture when it becomes soft.

This is a degeneration which brings the new growth into a state favourable for its absorption, or to the *resolution* of an inflammation. Examples of such an absorption may be seen in *rheumatic iritis*, and the observations of Dr. Kirkes on the rarity of adhesions of the pericardium in comparison with the frequency of pericarditis may also be explained in this way.

(3.) Melanic degeneration of lymph and new growths is not unfrequent, as in *peritonitis*.

Concurrent with these degenerations of the lymph granules and molecules are the degenerations of the *corpuscular elements*.

(1.) They may wither, as in the dried-up pus of chronic abscesses.

(2.) The fatty degeneration of cells is said to be shown in their transition to the *granule cell*, known also as the *inflammatory globule* of Gluge, or the *exudation corpuscle* of Bennett. The history of the formation or growth of these corpuscles is still doubtful.

The description of them, as originally given by Gluge, in describing the alterations of blood in inflamed parts, is as follows:—

He observes, “that the blood globules lose their tegument and their colour. Their inner substance alone remains, which, however, does not remain solitary; but by means of a whitish connecting material the masses become agglomerated, and form dense, opaque, round groups,

containing on an average from twenty to thirty of the smaller bodies, which, examined singly, are quite light and transparent. By means of pressure or acetic acid the associated granules break down into the individual bodies, and we see that the opacity is merely owing to the association. The associated bodies have a diameter in the mass of from $\frac{1}{50}$ th to $\frac{1}{40}$ th of a millimetre; the single granules are from $\frac{1}{80}$ th to $\frac{1}{60}$ th of a millimetre. These associated bodies," says Gluge, "I have seen in the blood-vessels, so that we have not here to do with a fluid which, transuding through the coats of the blood-vessels, is changed into granules. They escape by bursting the capillaries."

That this cell or corpuscle is formed within as well as without the blood-vessels, is apparent from an examination of inflammatory lungs or brain-substance. The corpuscles may be seen to coat the blood-vessels exteriorly and interiorly to their walls; and the formation of the corpuscle of Gluge can also be traced through stages of development, as described by Vogel, Bennett, Kölliker, Hasse, and myself: as well as through stages of degeneration from the normal state of some corpuscular elements (textural or morbid), the occurrence of which has been described by Reinhardt, Dr. Andrew Clark, Dr. W. T. Gairdner, and Mr. Paget.

The essential ingredient of which the compound granule cell is composed appears to be oily or fatty matter; and these cells vary considerably in their appearance, according to the fineness with which this matter is divided. In some the oil-drops are large, in others they are small and quite granular. They are by no means confined to inflammatory parts. Kölliker, in examining morbid products in an animal, has seen oval blood discs included in these corpuscles, showing that the cell membrane may be in some instances a subsequent formation in their progressive development. This view of their nature would imply that a number of the original oil or fluid granules come into contact with each other, and cohere into a glomerulus, which subsequently becomes invested with a membrane, and constitutes a cell, the contents of which gradually undergo some morphological process by which they are resolved, and ultimately pass into the circulation (SIMON).

My own observations on this point, published in 1849, and chiefly made upon inflamed pulmonary tissue, led me to express the same result, as to the nature of this compound corpuscular development, in the following statement:—

“(1.) The formation of clear, transparent, non-nucleated cells may be observed.

“(2.) The formation of cells with a nucleus and nucleolus are seen, differing from pus corpuscles in their large size, and in having a single nucleus. These are formed in the fluid of coagulated exuded matter, and become gradually filled by minute granules, which, when few in number, readily admit of the nucleus being seen. Subsequently, however, they conceal it; and the originally smooth cell membrane becomes rugged, the granular cell appearing as a spherical agglomeration of granules. Subsequently the cell wall appears to vanish, the enclosed granules to separate from one another, and to fall into irregular heaps.” (*Edin. Med. Journal*, No. 178, for 1849.)

The following are the general facts connected with the appearance of these corpuscles:—

“(1.) They are formed in greatest abundance during the first stage of the exudation (the second stage of pneumonia, according to Laennec).

“(2.) As long as the capillary circulation is going on, and before complete stagnation has taken place.

“(3.) When the redness and condensation is the greatest the corpuscles begin to disappear, or are not seen.

“(4.) They disappear altogether as the red softening passes into grey, becoming liquid.

“(5.) They are imperfectly formed, or not at all, in the deposits that occur during the progress of typhus fever or typhoid fever.”

Associating these observations with the descriptions of Mr. Paget relative to the liquefaction of fibrine;—with those also of Zwicky and Gulliver, who found these corpuscles in the softened apex or centre of arterial clots;—with those of Simon, who states that they are often found in the fibrinous clots of veins;—with their occurrence in the mammary secretion, in the softened parts of encephaloid cancer, in the vicinity of apoplectic effusions, and that generally they are extremely apt to be present where blood, or the products of exudation or secretion are undergoing absorption;—does it not appear probable, moreover, from the lucid description given by Mr. Paget—(when he says, that during the formation of these corpuscles “they present a gradual increase of shining black-edged particles, like minute oil-drops, which accumulate in the cell cavity, and increase in number, and sometimes in size also, till they fill it”)—that these compound granular cells, when associated with inflammatory products, fulfil a very

important function, as the media through which the liquefied, softened, and disintegrated products of inflammation are gradually absorbed?

The observations of Reinhardt, Dr. Andrew Clark, Paget, and Gairdner also place it beyond a doubt, that compound granular cells may also result from a fatty degeneration of the textural cells of a part; just as calcareous or pigmental degenerations occur, and which are also common to primordial cells. While there can be no doubt, therefore, that fatty degeneration of lymph or textural elements may lead to the appearance of compound granular cells, that process can scarcely be called degeneration which is associated with development, growth, and complete absorption, by which the indurated and confused parts of an inflammation such as the solidified portions of a lung in pneumonia, are ultimately cleared up.

Degenerate products are usually persistent, but the compound granule cell is not. It seems to have an important function to perform in the removal of fluid, effete, or softened exudations, after which it too disappears.

The most frequent and important result of inflammation is the formation of pus by the growth of pus cells. If a phlegmon or boil be observed, when it is a firm, hard, and solid mass of texture and exudation, we may feel in a few days that the solid mass has become fluid, and that it has not increased in bulk. The solidity and hardness are due to the inflammatory changes and effusion, the softening is due to the growth of pus cells developed from the germinal elements of surrounding tissue (VIRCHOW, BEALE). So it is with the cells of vesicular eruptions which become pustular. The new cells there also become pus cells—a change which may be accomplished in twelve hours at the most (PAGET). The following circumstances point to the development of pus from pre-existing germinal matter, namely, that,—(1.) A preliminary lymph cell cannot always be discerned; (2.) The modification of the suppurative process, which occurs in the inflammation of mucous surfaces, where the formation of pus seems at once to take the place of the natural cell-growth, without any apparent distinction or alteration of the membranes of the mucous cells, corresponding in this instance to the most simple idea one can have of what Virchow terms *parenchymatous inflammation*, as described at page 73. Ultimately the natural mucous secretion undergoes a

change. The characteristic cells on its surface drop off in all stages of abortion. Impaired cohesion of parts, an invariable expression of the inflammatory tendency, results. The epithelial covering becomes less characteristic in its form, and gradually declines to small and simple cells, which become mingled with many primordial cells, which appear to have been hurried from the surface before they had time to undergo their legitimate development into the perfect mucous cells. From this sketch of what occurs, "it will be obvious," as Mr. Simon writes, "that the anatomical distinction between pus and mucus must be as useless as the so-called chemical tests. Infinite gradations between the two fluids destroy all practical value in such criteria. Mucus, *as a copious fluid secretion*, has no existence in health; the only natural secretion of a mucous membrane is its epithelium, which ought not to exist in quantity sufficient for any evident discharge. If the secretion be hurried, it immediately begins to assume the forms and physical characters of pus, even to the splitting of its nuclei with acetic acid." In short, the essential process of inflammation has been established in the cell itself, by the abnormal nutritive morphological relations which take place between it and the blood in the processes of life.

Inflammations of mucous membrane with a *mucinous* exudation (quite as characteristic of inflammation as *fibrinous* exudations), appertain to certain organs, *e. g.*, in the gastric catarrhal inflammations. Such mucus is loaded with *mucin*, as a characteristic product of the inflamed mucous membrane, and which gives the tenacious, stringy character to the mucous fluid.

Between healthy pus and healthy mucus there can thus be no confusion; but there are conditions between the two which yield neither "*praiseworthy*" pus nor healthy mucus.

Formation of Pus—Suppuration.—Pus is a peculiar fluid, specifically heavier than water, averaging generally about 1·030. Well formed, perfectly elaborated pus is a smooth, viscid, yellowish or cream-coloured fluid, having little or no smell, and of an alkaline re-action. Microscopically, it is seen to be composed of certain essential constituents, namely, the pus cell, and often minute clear particles, which seem to have some relation as rudiments of nuclei of the pus cells. These constituents float in a fluid or serum called the *liquor puris*. The *pus cells* are about $\frac{1}{1000}$ th to $\frac{1}{2000}$ th of an inch in diameter, pellucid, filled with semi-fluid albuminous con-

tents, and sometimes containing a few minute oil globules, which give the cells a granular appearance. Their shape appears to depend upon the density of the *liquor puris*. Sometimes a distinct, circular, dark-edged nucleus may be seen in the paler corpuscles, and sometimes two, or even three particles, like a divided nucleus. The minute clear particles often seen are not more than $\frac{1}{1000}$ th of an inch in size. Such are the components of *good, healthy, or praiseworthy pus*, the *pus laudabile* of the older authors, literally, the *pus to be commended*, as showing a benign form of inflammation, indicating that the process, though a morbid one—a disease—is going on regularly, and promises a fortunate issue (WATSON). It is the *laudable pus* of surgical writers. When, however, the process deviates from the state of health—deviates from the usual and regular course of the morbid action in a person otherwise healthy—then we find not only variations in the pus cells, but multiform mixtures of withered cells appear, with molecular and fatty matter, escaped and shrivelled nuclei, blood corpuscles, and fragments of granular matter like shreds of fibrine. The liquor puris becomes unduly liquid, and the pus is then said to be *watery* or *ichorous*. It may even, in weak and tuberculous patients, consist chiefly of a thin serum, mixed with flakes or curdled, when it has been called *serous pus*. When the colouring matter of blood is mixed with it, it is called *sanious pus*. Chemical or vital changes of various kinds bring about a peculiar decomposition in pus while yet in contact with living parts, although it is probable that atmospheric air, or gases from an internal cavity, may have to do with the change; but hydro-sulphate of ammonia is frequently developed, especially in abscesses about the alimentary canal, near the tonsils or the rectum. The stench is then most offensive when the fluid is set free. Pus, also, besides possessing certain chemical properties, may possess certain specific properties: thus it may be impregnated with certain poisons, as that of syphilis, or of small-pox; it is also often, in certain constitutional states, loaded with foreign matters such as urate of soda.

The formation of pus is termed *suppuration*. It takes place under three conditions, namely:—(1.) Circumscribed; (2.) Diffused; and (3.) Superficial.

As examples of the circumscribed formation of pus may be mentioned an *abscess*, a *boil*, or *phlegmon*, in which the suppura-

tion is enclosed within a cavity whose walls are composed of connective areolar tissue, and into which interstitial exudation of inflammatory lymph and serum has extended over a certain area. It happens that while the central portion of an area has become purulent (*i. e.*, has produced pus cells as a result of the continuous proliferation of tissue), the peripheral part has maintained its firmness and solidity by activity of nuclear growth—and sometimes a “thin, opaque, yellowish-white layer, easily detached,” separates the suppuration area from the denser part. This has been called a “*pyogenic membrane*,” from the supposition that its function is to secrete the pus, whereas the nuclei and cells of the denser part are growing by continuous development into pus cells. Abscesses are sometimes formed without any of the usual accompanying signs of inflammation being present. They are generally slowly formed, and are named *cold* or *chronic* abscesses. When suppuration happens in the natural cavities of the body it is still circumscribed. It is not then, however, called an *abscess*, but a *purulent effusion*.

Diffuse Suppuration is exemplified in *phlegmonous erysipelas*, or the *purulent infiltration* of an organ. In such cases the inflammation extends through a wide extent of tissue, and from first to last the boundaries are ill defined. The growth of pus cells is distinctly and minutely interstitial. They are generally rapidly formed, and the tissue becomes thoroughly infiltrated, as if soaked in pus. The usual want of cohesion in the elements of tissue involved prevails from the first, and ultimately large *sloughs* or death of portions of texture may take place. In some textures of a loose kind it is also believed that the pus may spread about or infiltrate parts by its own gravity, thereby leading to secondary destruction of parts, and the formation of what are called *sinuses*.

The incipient progress of diffuse suppuration is probably not dissimilar to that of a phlegmonous abscess, but the inflammation is generally of a different type, and all the processes are less complete; thus, no fibrinous lymph circumscribes the limits of the abscess, nor does any membrane form to limit the pus. The process of suppuration is also less perfect, so that the abscess often contains shreds, or even large portions of mortified and loose cellular tissue. The pus is less healthy, is thinner, containing a larger portion of serum, and oftentimes portions of loose fibrinous lymph. The *pointing* of this form of abscess differs also from

that of the phlegmonous abscess, for the pus readily passes from its original seat by infiltration of contiguous portions of healthy membrane, and, gravitating towards the most depending position, presents a soft, broad surface, without any indications of *pointing*.

Such collections of matter are always of greater extent than phlegmonous abscesses, for the free transmission of pus from part to part occasions a great extension of the original disease. When these diffused abscesses open, the phenomena which result depend very much on the nature of the opening, and how it has been effected. "I have," says Mr. Hunter, "seen large lumbar abscesses open of themselves on the lower part of the loins, which have discharged a large quantity of matter, then close up, then open anew, and so go on for months, without giving rise to any disturbance; but when opened, so as to give a free discharge to the matter, inflammation has immediately succeeded, fever has come on, and from the situation of the inflamed part, as well as from the extent of the lesion, death in a very few days has been the consequence. The same result has also occurred from liberating collections of the diffuse suppurative process in other parts. In erysipelas, however, which so often gives rise to this form of abscess, a free opening is often necessary, to allow of the escape of the portions of loose areolar tissue they contain.

Superficial suppuration may be observed in *gonorrhœa*, *purulent ophthalmia*, and generally in *inflammation of mucous and cutaneous surfaces*; and the growth of pus can be clearly traced where stratified, as well as columnar, epithelium naturally exists. Upon the skin the development of pus may be seen to proceed from the *rete Malpighii*, as a growth by continuous development of new cells from this part of the young cuticle. In proportion as these young cells give birth to younger germs (proliferate), a separation of the harder layer of epidermis ensues, and a vesicle or pustule is the result. The exact spot where the growth of pus occurs corresponds to what would be the superficial layer of the *rete Malpighii*; and if the membrane of the vesicle be stripped off, the cells of the *rete*, in process of conversion into pus, in place of epithelium, will adhere to the epidermis, and be stripped off with it (VIRCHOW). In the deeper layers the cell elements, which originally have only single nuclei (centres of nutrition, growing, or germinal centres), divide, so

that their nuclei (or centres of growth) become more abundant. Single cells have their places taken by several, which, in their turn, again provide themselves with dividing nuclei, and so the process of multiplication goes on.

Dr. D. R. Haldane, of Edinburgh, has observed and recorded the continuous development of pus cells from the cylindrical variety of epithelium. In a case of small-pox he found the larynx and trachea coated over with a soft, dirty-looking deposit, which was found to consist of pus cells. On gently scraping the surface, the cells were found enlarged, and, in place of containing a single nucleus, each contained several—three, four, or more. These were derived from the proliferation of the original nucleus. External to the cells were young ones in all stages of development. (*Edinburgh Medical Journal*, Nov. 1862, p. 439.)

The more completely the epithelium is of the stratified kind, the less is the surface liable to ulceration (*e. g.*, the urethra in gonorrhœa); and those mucous surfaces where the epithelium is of the cylindrical form scarcely ever produce pus without ulceration (*e. g.*, the intestines). Pus cells, mucous cells, and epithelial cells are now regarded pathologically as equivalent elements, and which may replace one another; but physiologically they are not equivalent elements, inasmuch as they cannot perform each other's functions. Deeply seated pus formation may proceed from *connective tissue*, or from the nuclei of vessels or sheaths of tissue. An enlargement of the *connective tissue* germs occurs (OTTO WEBER), which divide and subdivide, and so multiply excessively by divisions of the larger germinal masses or cells. Round about the irritated or inflamed parts, where single cells lay, masses or groups of cells are formed, a large new formation grows, and towards the interior of which heaps of little cells accumulate. These little accumulations occur at first as diffuse "infiltrations" of roundish masses, encircled by an intermediate growth, which continually liquefies as proliferation of the little cells extends. Virchow regards this liquefaction as of a chemical nature; the intermediate substance (which yields gelatine) becomes transformed into mucus, and being ultimately converted into an albuminous fluid, is thus rendered liquid. Thus two different modes of pus formation are distinguished, according as (1.) the growth of the pus cells proceeds from the germs of *superficial* tissue, like *epithelium*, or (2.) from *connective tissue*; and

two forms of inflammation can in like manner be separated from each other, namely,—(1.) The *parenchymatous inflammation*, where the process runs its course in the interior of the tissue elements (*e.g.*, connective tissue cells or germ masses, hepatic cells), without our being able to detect the presence of any free fluid which has escaped from the blood, but where softening and fluidity is due to the process above described. (2.) The *secretory (exudative) inflammation* of superficial tissue elements, where an increased escape of fluid takes place from the blood, and conveys the new products of growth and secretion along with it to the surface.

The *parenchymatous inflammation* has from its outset a tendency to alter the elements of tissue and their special functions. Whereas the *secretory inflammation*, with a free exudation, in general affords a certain degree of relief to the part. Witness the relief which follows the free flow of mucus in catarrh. It conveys away a great mass of noxious matter, and the part appears to suffer much less than a part which is the seat of a purely *parenchymatous inflammation*. In gonorrhœa also we have an example of how the pus resulting from the *secretory* form of inflammation is carried away by that transudation of fluid (exudation) which removes the pus cells from the surface, without the slightest appearance of ulceration (VIRCHOW).

The description here given regarding the formation of pus is based on the great fact, demonstrated originally by Goodsir, Virchow, and others, that all new cells proceed from “centres of nutrition,” from other cells, or from the nuclei of them; and as Dr. Haldane justly observes,—“We must not expect to be able, in the case of every abscess or purulent discharge, to trace thus distinctly (as has been done in the preceding paragraphs) the origin of the pus cells. There is only a certain stage in pathological as in physiological growth, in which the actual mode of development can be followed. We might as well expect to be able to discover, by an examination of the mature foetus, the different steps by which its organs had been formed, as to be able, in a ripe abscess, to determine in what way normal had been converted into abnormal tissues.”

There are especially three events which, with more or less frequency, accompany or follow inflammation in a part. These are *softening*, *ulceration*, and *mortification*.

Softening, or diminished cohesion of tissue, is an almost con-

stant result. It may be due not merely to mechanical separation by infiltration of the component elements of tissue, but to a loss of the vital cohesive properties and impaired function of the tissues themselves, which tends towards their liquefaction and degeneration. Examples of this may be seen in the inflammation which takes place upon mucous surfaces already referred to, also in the inflammatory red softening of the brain and spinal cord, in the lungs, where a peculiar brittleness and rottenness is imparted to their fibrous substance or skeleton texture. These are due to vital changes in the proper tissue, often independent of any interstitial infiltration. The most remarkable example of inflammatory softening is that which occurs in bones. An acutely inflamed bone is soft, and may be cut with a knife (STANLEY, PAGET).

But while some parts are *softened*, others are removed altogether, by the process of *interstitial absorption*, as it has been termed. This phenomenon is also best seen in bones which have been inflamed. Such absorption of parts gradually precedes the extension of the inflammatory process, and leads, in the case of abscesses, to their spontaneous evacuation, as seen in what is commonly called the "*pointing of an abscess*." The inflammation continues, and the growth of pus moves along in a definite direction, towards the cutaneous or mucous surfaces of the body in its vicinity; but as the integuments are generally the more prone to inflammation, it is probable that they thus become soft and yield sooner than the mucous surfaces do.

Ulceration.—This process goes on in the following way, as seen on an open surface, such as a wound or sore. Three processes go on simultaneously in order to effect ulceration:—(1.) An exudation of *inflammatory lymph* and *serum* surrounds the mass of young cell elements which constantly continue to grow and to break up (proliferation). (2.) Cells are thus continually growing on the surface, to be carried off by a fresh exudation. (3.) Liquefaction of the gelatinous interstitial tissue supervenes, and so destruction of tissue takes place continuously. Thus an ulcer forms.

Granulation is one of the modes in which a wound, or sore, or a part previously acutely inflamed, heals. It is then said to do so by "second intention," and is always a reparative process. Granulation may occur with or without suppuration. The first

mode is extremely common. The latter is occasionally seen in the healing of syphilitic maculæ and ulcers of the cornea, and Mr. Hunter conceives he once met with it in the union of a broken thigh bone.

Granulation is associated with an exudation of inflammatory lymph, into which old vessels extend, and new ones are formed, and a new surface results, which is "granular"—the granule being a small conical tumor or growth, composed of a mesh of terminal loops, formed by the capillary vessels shooting into the effused lymph. The figure and colour of the granulation, says Mr. Travers, are determined by the state of the circulation; when that is feeble and inclined to stagnate, the granulation is broad, flat, and spongy, and either pale or of a livid hue; when, on the contrary, it is vigorous, the granulation is conical or acuminate, and of a bright red tint. The vessels prolonged into the granulation are more or less tortuous, and so numerous as to require a high magnifying power to exhibit their distinctness after successful injection. These vessels become contracted to obliteration as the period of cicatrization approaches. Granulation may take place from a surface, or from the sides of an abscess. If from the cutaneous tissue, the sore heals by a process of skinning; the skin, according to Mr. Travers, always springing from the edges of the wound, even in cases when the new tissue first appears in the central parts. Again, if granulations spring from the walls of an abscess, their opposite surfaces for the most part unite. Granulations sometimes form most rapidly. Mr. Hunter has seen, after trephining a patient, the dura mater strongly united to the scalp in twenty-four hours. Granulations, however, have not in all cases an equal disposition to unite. Thus the granulations of fistulous abscesses are little prone to adhere, their surfaces being often as difficult to unite as those of a mucous membrane; indeed it is often impossible to produce adhesion except by exciting a considerable inflammation. A part having healed by granulation uniformly contracts. This contractile force is so great that although the sore made by the amputation of a thigh is seldom less than seven or eight inches in diameter, yet the cicatrix left on healing is hardly more than a crown piece. It is from this cause that we always find in viscera that have been the seat of abscess, a marked depression at the point of cicatrization.

The reproductive energy of parts which heal by granulation,

however, is not great. It is rare that the original tissue is perfectly reproduced. No fat, for instance, is regenerated in ulcerated adipose tissues; a muscle being divided unites by a cicatrix of connective tissue, no muscular fibre being reproduced, and a divided cartilage unites by tough fibrous tissue, but not by a cartilaginous bond of union. The skin, when destroyed, may be reproduced as a good imitation, yet generally it is imperfect. After small-pox the *rete mucosum* is either slow in forming or never forms at all, so that the cicatrix or *pit* remains whiter than natural. Neither the smooth muscular fibres, nor any of the glandular structures of the skin are formed in its scars; but its fibro-areolar and elastic tissues, its papillæ, and epidermis are all well formed in them. The reparation of the mucous membrane is equally imperfect, the villi being always wanting. The reparation of a flat bone, such as the cranium, is so slow that ten, twenty, and even fifty years pass away before a small trephine hole is filled up with bony matter. In like manner, a healed cavity of the lungs is always marked by a cicatrix of areolar tissue altogether different from the original structure; neither, as far as we know, is the proper tissue of the liver, of the spleen, or of the kidney restored. A nerve simply divided is united by nervous matter in about twelve months or more; and the union is quicker and better in all tissues if air is excluded from the healing of the part.

It is a rule, also, of all cicatrices, that the newly formed part is harder and of greater density than the original structure. Muscle, for instance, unites by coarse, dense, connective tissue; tendon most frequently by a harder and less pliant, but not tougher tissue, and sometimes by bone; and bone after a fracture is a more compact substance, and contains more phosphate of lime, than before the accident; but, notwithstanding this addition, the new bond of union is not so strong, nor the living actions so energetic, as in the original structure. For when the constitution becomes enfeebled by severe disease, of a scorbutic kind especially, an old sore has been known to open, and the ends of a once broken bone again to separate. It is equally a rule that a part having been once inflamed, the liability of the part to that form of inflammation is greatly increased; and also when new membranes or tissues have formed, that these tissues are infinitely more prone to disease than the original membrane.

Mortification is the death of a part, and may be complete or incomplete. In the soft parts the former is termed *sphacelus*, and the latter *gangrene*; while in hard parts, as the bones, there is a somewhat similar distinction, namely, into *caries* and *necrosis*.

Mortification of the soft parts may be white or black in appearance, humid or dry. The mortified part has a black aspect when the blood is extravasated through the walls of the blood-vessels into the affected tissues, giving to the part a purple or dingy hue, while to the touch it is soft, inelastic, and doughy. The mortified part may appear white when, by the action of cold, the blood has been driven from the part, which subsequently freezes perfectly white.

Humid mortification occurs when the blood transudes in a fluid state, and after its exudation separates into its constituent parts, so that the serum, set free, dissolves in it the red globules, raises up the cuticle in bladders, and forms what are termed "*phlyctenæ*." Air, generated by a process of commencing putrefaction, is not unfrequently contained in the *phlyctenæ*, and gives, to the finger touching the part, a sensation of crepitation.

Dry mortification is a rare disease, and is sometimes supposed to be caused by the ergot of rye, or other diseased grain, used as food, giving rise to the disease known as *ergotism*. In the year 1716 dry mortification appears to have been to a certain extent epidemic at Orleans, fifty cases having been treated at the Hôtel Dieu of that city. Dodard described it as beginning generally in one or both feet, with pain, redness, and a sensation of heat or burning like that produced by fire. At the end of some days the part became cold, as black as charcoal, and as dry as if it had been passed through fire. Sometimes a line of separation was formed between the dead and the living parts, and the complete separation of the limb was effected by nature alone, and in one case the thigh separated in this manner from the body at the hip joint. In other cases amputation was necessary. Mr. Solly has given an interesting case of this description, which occurred in the practice of Mr. Bayley, of Odiham. The patient was a child three years and seven months old, from whom, by this spontaneous process of nature, both arms were removed above the elbow, the left leg below the middle of the thigh, and the right foot above the ankle joint, being a remarkable instance, in modern

times, of this destructive disease. (See *Ergotism*, and *Med.-Ch. Trans.*, vol. xxii., 23.)

The bones, the brain, the lungs, the liver, the spleen, and the kidney are all liable to *sphacelus* and *gangrene*; so are the different tissues, as the cellular and cutaneous tissues, the nervous and serous tissues. The muscles, tendons, aponeuroses, and blood-vessels are likewise all liable, but in a less degree, to these formidable affections, which are sometimes the effect of inflammation, and in some instances seem to be idiopathic.

Local and General Symptoms of Inflammation.

Bedness, or at least increased afflux of blood, swelling, or at least increased textural productivity, pain, throbbing, increased sensibility, disorder of function, arrest and change of secretion, are the phenomena which are for the most part associated with the local morbid state, or with the textures in its immediate vicinity. Increased local heat under all circumstances is constant. This has been recently proved to demonstration by the ingenious experiments of Mr. Simon and his colleague, Dr. Edmund Montgomery. (*A System of Surgery*, edited by T. Holmes, M.A., vol. i., p. 42.) If the local process of inflammation, however, is carried on upon a minute scale, or in certain tissues, one or other or more of these symptoms may be absent; if, on the other hand, the local process proceeds on an extensive scale, and involves important and delicate textures of vital importance, then we have much more unequivocal expression given, not only to local symptoms, but to complex morbid processes affecting the constitution generally. Of these the chief are:—

I. **Inflammatory Fever.**—Of the *constitutional symptoms*, as they are termed, the most prominent are those which indicate “*inflammatory fever*, *symptomatic fever*, or *sympathetic fever*.” These constitutional symptoms are of the greatest importance, not only by indicating the nature of the disease, as when the inflammation is connected with an internal organ removed from sight and touch; but they are highly important as a guide to treatment. The premonitory symptoms of coldness and shivering are usually very decided, but not of long duration. They are succeeded by a stage of re-action. The pulse is then hard and swift. There is thirst and greatly increased heat of surface. The secretions and the appetite may not at first vary much from the normal state,

but on the whole are diminished. Exhaustion and emaciation do not proceed rapidly. This fever is pre-eminently one of strong re-action and vascular excitement, and these characteristics may be said to constitute its *type*.

A most minute description of the disorder of the general frame by *inflammatory fever*, according to its effect on the *systems* of the body, is thus condensed from the account given by Professor James Millar (*Principles of Surgery*, p. 39):—

(1.) *The Nervous System*. There are aching, dull pains in the loins and limbs, restlessness, and much discomfort. The will and the power of exertion are diminished. Anxiety or foreboding of evil is felt, and expressed upon the countenance. The head is generally hot, the face flushed, the eyes suffused, and the skin hot and dry. Special sensation is at first exalted, but afterwards the intellectual functions become more and more disturbed. Ultimately delirium is established, and coma may ensue. (2.) *The Vascular System*. The pulse ranges from 80 to 120, or more, and the heart's action is proportionally rapid. The pulse is hard, rolling like a cord below the finger, and yielding but little to its pressure; or an irregularity of movement in the artery may exist, and thus a thrill or jar is imparted to the finger. There is increased fullness, as if the vessel were itself enlarged, and held a larger quantity of blood at each impulse; the heart is acting not only more rapidly, but more powerfully than in health; and the circulation is truly accelerated. Frequency, hardness, thrilling, are seldom, if ever, absent; but fullness may be wanting, and the pulse may be small instead of full. This modification is chiefly observed during serious inflammatory action, affecting important internal organs situated in the abdominal region. Hence it is sometimes termed the *abdominal pulse*; the artery resembling a hard thrilling thread rather than a cord. This pulse always exists in connection with great nervous depression, and debilitated though rapid cardiac action; to which circumstance its smallness is probably due. In affections of the brain, on the other hand, producing coma, the pulse is commonly slow and full; the suspension of cerebral influence appearing to diminish the rapidity, without affecting the force, of the heart's action. There are idiosyncrasies also to be taken into account. The pulse may be naturally slow or rapid—fifty or ninety; and this must be allowed for, when previous inquiry has satisfied us that the patient is the

subject of such peculiarity. (3.) *The Respiratory*. Respiration is quickened; the breath is felt to be hotter than usual; and an oppression is complained of in the chest. (4.) *The Digestive*. The tongue may be loaded, white, and moist; or the edges and central tip may be red and dry; the latter is probably the more frequent combination. (5.) *The Secerning*. The secretions and excretions in general are materially diminished. The bowels are constipated—mainly from want of mucous secretion from their lining membrane; the skin is hot and dry; the mouth is parched; the urine is scanty, high coloured, generally acid, sparingly aqueous, and holding much saline matter, with comparatively little urea, in solution. (6.) *The Nutritive*. Digestion is interrupted; so is assimilation; as the fever advances, so does emaciation; and strength is more and more prostrate.

The chilliness, often amounting to shivering, marks the *date* of the febrile disturbance; and rigors more frequently attend the commencement of spontaneous inflammation than of inflammation caused by external injury.

Regarding the constitutional state characteristic of inflammatory fever, some important general conclusions, especially insisted on by Dr. Alison and Dr. Watson, may be thus shortly stated:—

(1.) It is to be observed that there is no fixed relation between the degree or intensity of internal inflammations and the constitutional fever attending them; nor is the fever always proportioned in its degree of violence to either the size or importance of the part inflamed. In some cases, writes Dr. Alison, where we are sure that we have had inflammation going on under our inspection, to extensive effusion of pus, the pulse has been feeble, the skin cool and damp, and the patient exhausted and faint on the slightest exertion; while in others there is high and more inflammatory fever, and in some of these the organ inflamed has been so to no extent, and its function comparatively little affected, but yet the patient has become comatose nearly as in typhus, and died so. Laennec makes an observation of a similar kind (*Ed. Med. Journal*, May, 1857), and Dr. Watson observes, that the fever may be high and very strongly marked in that common complaint the *quinsy*, *cynanche tonsillaris*, or *tonsillia*, which can scarcely ever be said to imply much danger. (2.) The situation, the extent, and the degree of the local inflammation being the

same, the fever commonly runs higher in young and in plethoric persons, and in those of sanguine temperament, than under opposite conditions. (3.) Inflammatory fever is modified in its expression, and especially in the characters of the pulse, by the nature of the part which is inflamed. This has been already alluded to in regard to inflammations of the abdomen, where the action of the heart is depressed, and the pulse is changed accordingly, tending to death by asthenia; and also in regard to the brain, when the mode of death tends to be by coma, the pulse being slow, laboured, and full. (4.) The type of the inflammatory fever is very much modified by constitutional circumstances, such as the previous habits of the patient, and whether any zymotic disease is associated with the local inflammation. (5.) The inflammatory fever undergoes a further change of type (*a*) when suppuration takes place; (*b*) when it continues long; and (*c*) when mortification or gangrene occurs to a large extent. (6.) The febrile state follows generally the local disease; but (7.) there is also good reason to believe that the *pyrexial* condition, and the condition of *inflammation* in a part may be excited in some instances conjointly; or, at all events, their periods of commencement may correspond so closely that it is difficult to conceive that one is the effect of the other. Observations are much wanted as to the exact ranges of temperature, as measured by the thermometer, in cases of inflammatory fever, and so to verify or set aside such general statements.

When inflammation proceeds to suppuration, a severe paroxysm of shivering is often the first indication of the formation of the pus, and the character of the fever undergoes a great alteration from that just described. The degree of the fever varies greatly even in this case, for a most copious formation of pus may take place from a mucous membrane, as that of the bronchi or urethra, and yet the constitution may hardly suffer in any appreciable degree; while a trifling amount of pus from a serous membrane will often be associated by fever of a fatal character.

In any case the character of the fever depends in a great measure on the constitution of the patient. If that be good, the fever is attended with a white tongue, with little tendency to become brown, also with much heat, and a full strong pulse. On the contrary, if the patient's constitution be broken or impaired, the fever is of a low type—*asthenic*, as it is called. The

event of *suppuration* is generally marked by a *rigor* of greater or less severity, while the fever hitherto has been *sthenic*. It is *the occurrence of the rigor* in the course of the inflammatory febrile state which gives it prominence and importance. It attracts the attention of the patient generally, and indicates to the physician that *pus* has been produced in the part or organ inflamed. As soon as suppuration is complete, and the abscess ripens, or pus approaches a surface to be discharged, and especially if any important organ is its seat, the fever tends to become *asthenic*, with a brown tongue and a rapid pulse, while the local pain in a great measure subsides. At this period the abscess must open spontaneously, or be opened by art, otherwise the patient may be in danger. The opening of the abscess, though attended with much pain from the contracting of the inflamed walls, is usually followed by great relief of all the constitutional symptoms; the pulse rises, the tongue cleans, the appetite returns, and a visible and immediate amendment takes place. If, however, the patient has been exhausted by his sufferings in the earlier stages of the disease, the relief afforded is but transient, the pus degenerates into a *sanies*, or is altogether suppressed, fever changes its type, and the patient sinks, too enfeebled to establish the reparatory process.

II. *Typhoid Fever*.—The *type of fever* just referred to is known by the name of *typhoid*. Its character is *asthenic* or *adynamic*. Feeble and more feeble the patient becomes, the pulse sinks; there is great impairment of the heart's action and tendency to collapse; the features become pinched, shrunken, damp, and ghastly; and the skin is covered with a cold and clammy perspiration. Sometimes these *adynamic* characters may pass into that typhoid state in which nervous symptoms, such as delirium, somnolence, and tremors, prevail. These characters are known as *nervous* or *ataxic*. The tongue becomes dry, black, and tremulous, sordes cover the teeth, and harden on the lips and angles of the mouth. Low muttering delirium, stupor, or coma prevail; tremors affect the voluntary muscles, and the *fæces* and urine pass unnoticed. This form of fever sets in as a consequence of some untoward or unhealthy tendency of the inflammatory process, such as when mortification of the part occurs. Any cause, however, by which the system becomes extensively vitiated will bring about this form of fever.

It is not necessary that the part should die. Putrescence may induce the typhoid state; the infiltrated exudations in the inflamed part, degenerating and decomposing, poison the fluids circulating amongst them, and so, by absorption, induce the typhoid state. If this happens with an internal organ the event is generally indicated by a sudden cessation of all pain, at which the patient often appears very happy and even joyous, while to the experienced physician its sudden cessation is assuredly an evil omen (WATSON). The most important vital functions are deeply impaired by a prolonged existence of this type of fever. It tends to death by a complete sinking of the circulation, diminution and loss of animal heat; or deepening stupor, with oppressed respiration, supervenes, or the patient dies by a combination of both conditions, *asthenia* and *coma*.

III. Hectic Fever.—If suppuration continues beyond the powers of the constitution to supply the process with material to form inflammatory lymph and pus—if the inflammation continues and becomes chronic as to time, inflammatory lymph continuing to be exuded, and pus continuing to form in profuse quantity, especially if an internal organ is its site—another type of *febrile* symptoms are apt to supervene, constituting *hectic fever*. It is not to be supposed, however, as was once believed and taught, that *hectic fever* is due, in every case in which it occurs, to the continued formation of pus. There are forms of *hectic fever* unconnected with suppuration anywhere, but associated with some analogous wasting of the bodily substance; for example, a prolonged secretion of milk in mothers who suckle their infants beyond the natural period. In all cases where a drain upon the system is established beyond its means, such a complex morbid condition of the body as *hectic fever* may be thus induced, and the mischief may not be revealed by any other symptoms. This type is particularly distinguished from the inflammatory and typhoid forms of fever by its remarkable intermissions, which are usually periodical; a period of remission and a period of exacerbation usually occurring once, and sometimes twice, in the twenty-four hours. It is also characterized by an excessive waste of the tissues of the body; and the sweating which attends the paroxysms causes great exhaustion. The assimilative and nervous functions are comparatively unimpaired, so that it is a febrile state generally of very long continuance. The

mind remains perfectly clear, often vigorous and active, even when the body is debilitated; and if the intervals between the paroxysms are tolerably free from febrile excitement, the *hectic* type of fever may be protracted much beyond what at first sight might appear credible; and thus it is sometimes within our power to alleviate greatly this condition. If, however, the fever does not abate during the remissions of the excessive paroxysm, when sweating continues profuse, and when suppuration or other wasting discharge is excessive, the fatal termination approaches rapidly.

The leading symptoms of this form of fever have been watched and described minutely by many observers, non-professional as well as professional. The *fever* creeps on insidiously, and almost imperceptibly; and the physician is at first led to suspect its existence by a very slightly increased frequency of pulse, and a small degree of heat of skin, occurring generally towards evening, and subsiding before the beginning of the next day. The pulse is also subject to temporary quick excitement from slight causes, such as by exertion, by emotion, or by food, as after meals. The heat is especially felt in the palms of the hands and soles of the feet. The excitement of the pulse gradually begins to be more and more easily induced throughout the day; and towards evening the general exacerbation of the febrile state becomes regular, and is unmistakable. *Periodic* exacerbations and remission now become distinctly marked. The exacerbation or febrile paroxysm occurs almost invariably towards evening, reaches its height about midnight, and terminates by a profuse perspiration or sweating stage towards the morning. This sweating is sometimes called *colliquative*, and sometimes may be replaced or accompanied by *diarrhœa*. Occasionally a second paroxysm occurs in the morning after breakfast (WOOD), or at noon, as described by Cullen; and as a mid-day meal was common in his day, it is probable that these slighter paroxysms may be attributed to such causes as the simple taking of food. Generally, however, in the earlier periods of this type of fever, the interval from morning till towards the afternoon and evening is free from fever; but in the advanced stage the fever becomes nearly constant, while the evening exacerbations and the morning sweats remain characteristic to the end. The pulse of the *hectic* patient is scarcely ever so hard and full as the pulse in *inflammatory fever*; nor is it so soft and compressible as the pulse of the

typhoid patient. It expresses a middle condition between the two, of very variable character, both as to quickness and strength, according to the degree of exhaustion of the patient and the amount of febrile re-action. Often during the paroxysm, or during temporary excitement from slight causes, it reaches 120 beats in the minute, the beat being performed with a jerk, as if the result of irritation upon a weakened heart (WOOD).

The heat of skin during the paroxysm is often considerable, and always distressing, so that little more than the slightest covering can be endured. The respirations are quick and short. The appearance of the face is so characteristic that the *hectic flush* of the cheek is a symptom now well known. It is limited to a spot in the centre of the cheek, its delicate bright red colour and circumscribed form contrasting strongly and often beautifully with the pale cheek, the bright and sparkling eye with its sclerotic of pearly whiteness. The surface of the skin is harsh and dry, and towards the close of life the region of the ankles are apt to become cedematous. The patient loses flesh rapidly, and as death approaches he becomes exceedingly emaciated. It is then that *diarrhœa* is apt to supervene and to aggravate the sweating, so as completely to exhaust the remaining strength. The mind, unclouded before, now gently wanders, and the functions of life cease, generally without a struggle. It is often one of the closing symptoms most strongly marked in pulmonary consumption; and the non-professional pen of our great novelist, Mr. Charles Dickens, has beautifully portrayed its more striking features in the death of Smike:—

“But there were times, and often too, when the sunken eye was too bright, the hollow cheek too flushed, the breath too thick and heavy in its course, the frame too feeble and exhausted, to escape their regard and notice. There is a dread disease which so prepares its victims, as it were, for death; which so refines it of its grosser aspect, and throws around familiar looks unearthly indications of the coming change—a dread disease, in which the struggle between soul and body is so gradual, quiet, and solemn, and the result so sure, that day by day, and grain by grain, the mortal part wastes and withers away, so that the spirit grows light, and sanguine with its lightening load; and feeling immortality at hand, deems it but a new term of mortal life—a disease in which death and life are so strangely blended that death takes the glow and hue of life, and life the gaunt and grisly form of death.”

The forms of fever now noticed, as phenomena which may be associated with the inflammatory process, are usually regarded as various *types* which the febrile state may assume.

SECTION III.—DEGENERATION OF TISSUE.

Definition.—*Degeneration of tissue implies such a departure from the normal state as would give rise to a palpable appearance in its minute elements of granular detritus, or of any deterioration; and which, by the functional actions of repair in the normal state could not have been left there, nor been visible.*

The circumstances under which degenerations occur are of the nature of decay and death. For example, degeneration occurs to an immense extent in the tissues of the aged, especially in the heart and arteries, and to a less extent in the voluntary muscles and the hard textures. Towards the close of the life of a part, also, degeneration takes place, as, for example, in the textures of the placenta towards the close of utero-gestation. To such degenerations Virchow has given the name of *necrobiosis*, because death and degeneration seem to be brought about by altered life at the close of natural existence. In this respect it may be truly said, that “As we begin to live we begin to die.” A spontaneous wearing out of living parts goes on, so that destruction and annihilation are immediately consequent upon life. *Softening* is the ultimate result of such degeneration, which becomes palpable chiefly by the decided friability of the parts. They lose their coherence, and at last really liquefy, so that pulpy or fluid products take their place. When it is remembered, also, how abundantly a granular fatty transformation occurs after death, the nature of degenerations becomes more intelligible; and my friend Dr. Lyons, Professor of Medicine in the Catholic University of Ireland, instituted a series of observations which beautifully demonstrated a process of morphic changes of tissues through dissolution and decay, till the mortal parts of our existence return “ashes to ashes,” and “dust to dust.” To these morphic changes he has given the name of “*Histolysis*.” To the same end are the demonstrations of Dr. Quain, regarding the conversion of muscle into fat, and of crude flesh generally into *adipocere*, accounting also for the enormous fattiness of certain geological strata in which animal remains are abundant

(MICHAELIS, quoted by SIMON). Such experiments and observations as those of Panum, Melsens, Ascherson, Gluge, Lyons, Simon, Brudach, Wagner, Michælis, and others, and in which granules, vesicles, and cell-forms appear to arise spontaneously out of homogeneous albuminous fluid, will go far to explain many of the conflicting accounts which are given of the nature of the inflammatory products just described, and of the degenerations; and especially by those observers who believe that granules, fibres, and cells may form independently of pre-existing germs. Such forms may undoubtedly arise, as these observers show; and having arisen, they decompose and advance through changes such as Dr. Lyons has described under the name of *histolysis*; whereas the *productive* results of inflammation seem undoubtedly to grow from pre-existing tissue elements, as has been already shown.

All these degenerations are examples of *atrophy with changes of texture* (PAGER), as distinguished from *atrophy* resulting from simple decrease of bulk, the organ or tissue otherwise retaining its usual structure and function.

(a) *Fatty Degeneration.*

Amongst the degenerations which are brought about by the spontaneous wearing out of living parts, the most widely spread, and the most important, is unquestionably the *fatty degeneration*. It is attended by a continually increasing accumulation of fat, which replaces the minute elements of tissue in different organs; and Simon concludes generally, regarding the presence of oil or fat in textures uninflamed, that it is essentially a sign of weakness or of death, representing decomposition of effective material. In such *necrobiosis* the elements of the tissue completely perish, and are replaced by fat granules. Examples of this degeneration may be seen in the minute elements of muscle, especially of the heart; also in the acini of the liver, contiguous to the capillaries into which the branches of the portal vein break up; and in such degeneration the cells ultimately disappear, leading to loss of substance and *atrophy* of the gland; in the blood-vessels, in the *corpora lutea* of the ovaries, in the renal epithelium, and in many pathological products, such as pus, tubercle, cancer, and the like, when in process of decay; and, in short, nearly all cell structures may undergo this degeneration, except, perhaps, red blood corpuscles and

the elements of nerve-tissue. In every texture the degeneration becomes evident in a similar manner. Isolated, extremely minute globules of fat appear in the cell contents, and becoming more abundant, they gradually fill up the cell cavity. Usually the fat granules appear at some distance from the nucleus; but ultimately the granules lie as close to each other as they do in the *colostrum corpuscles* of milk. At last the nucleus is no longer visible, and the membrane of the cell also disappears—probably by a species of solution. If the degeneration occurs in the more rigid structures, as, for example, in the walls of arteries, the fatty granules retain the form of the cell which they replace. Such degeneration in arteries is first seen in the connective tissue corpuscles composing the innermost layer of the internal coat. Afterwards the intermediate substance also softens, the degenerate fat-granule masses fall asunder, and the current of blood may carry away the particles of fat with it. Thus a number of uneven places (loss of tissue) may be produced upon the surface of the larger vessels without the appearance of ulceration (VIRCHOW).

In fatty degeneration of the substance of the heart there is discolouration of its whole substance. It assumes generally a pale, yellow hue, with peculiar spots on the papillary muscles. Short, yellow streaks, which communicate with each other, are to be seen in the direction of the primitive fasciculi, and which pervade the substance of the papillary muscles.

Yellow softening of the brain is also a form of fatty degeneration, and this yellowness is due to the accumulation of finely granular fat; and generally it may be said that, at every point where fatty degeneration attains a high pitch, great opacity will always present itself. A transparent part becomes opaque, as in the cornea, where the fatty clouding marks the *arcus senilis*, described by Mr. Canton, in persons past middle life, and which has been regarded as an index to the existence of fatty degeneration of other more important organs, although the importance of the sign appears to have been exaggerated. In some form of Bright's disease, also, the uriniferous tubules become filled with fattily degenerated epithelium, which appears on the surface as opaque spots.

Additional examples of this fatty degeneration are to be seen in the *fatty liver* and in *mollities ossium*, atrophied renal capsules, and thymus gland, and the muscles—voluntary as well

as involuntary—the fatty degenerations of the placenta, of cartilage, of bone, and of morbid growths; indeed, there is no kind of tissue, healthy or morbid, which may not undergo fatty degeneration.

When the normal structure of the part is thus transformed into fat it is ultimately destroyed, and the place of the histological elements is gradually occupied by a purely emulsive mass—a kind of milk or fatty *débris*—that is, an amorphous accumulation of fatty particles in a more or less highly albuminous fluid (VIRCHOW).

With reference to fatty *degeneration* in particular organs, see the account given of local diseases.

(b) *Mineral Degeneration—Petrification.*

The process which is followed by tissues undergoing this form of degeneration is very similar to that described in the previous paragraphs; but it is necessary to distinguish the forms of mineral degeneration as distinct from ossification. Formerly every kind of tissue condensed to the same degree as ossified or calcified parts was considered ossified, and the condition described as “*ossification*.” But although a part may have lime in its intercellular substance, and although stellate cells may be present in it, yet it may be merely “calcified,” or, as Virchow terms it, “*petrified*” tissue, and this condition he briefly describes as “*petrification*.” Pathological ossification presupposes that the tissue or part which ossifies is called into existence by growth, and not that a previously existing tissue or part merely assumes the form or hardness of bone by absorbing calcareous salts. Ossification always begins by a growth of new tissue; and deposition of calcareous salts does not take place till a comparatively late period.

Calcification or *Petrification* is a degeneration comparatively more frequent in the peripheral arteries, and it occurs most commonly in cases where there is a tendency to calcifications generally, and where calcareous salts are set free at other points in the system, to circulate with the juices (VIRCHOW). The lesion is to be distinguished also from *atheroma* of the arteries. In both conditions the artery may be felt to be a hard and rigid tube, with a calcareous feel to the knife or the touch. A careful examination microscopically will show that the degeneration is in the middle coat, that *calcification* or *petrification* of the minute

muscular cell elements has taken place, and that the fibre cells of the circular fibre coat are transformed into calcareous spindle-shaped bodies. The degeneration may also invade surrounding parts, while the internal coat of the artery may be unchanged. The larger arteries are often brittle from the mineral degeneration of their tissue—associated often with fatty degeneration (*atheroma*). Patches or plates of the mineral substance may be seen imbedded in the middle coat after the inner membrane is stripped off. When the smaller vessels undergo the mineral degeneration the deposit resembles particles of oil; and the nature of such an appearance can only be determined by the application of mineral acids, which will dissolve the mineral matter with effervescence.

Nerve cells, the fibrous membrane of the brain, the pia-mater, and the choroid plexus, are all liable to undergo the mineral degeneration.

Exudations and new growths are also similarly liable. Dr. Bennett has seen the gall bladder converted into a calcareous shell, and the pericardium into an unyielding box of mineral matter enclosing the heart. The cardiac valves are often covered with mineral encrustations.

Cancer and tubercle growths are also transformed by the mineral degeneration; and Dr. Bennett has shown how the calcareous transformation of tubercles is the natural mode of arresting their advance.

The degeneration may also follow upon metastasis of calcareous salts, not excreted by the kidneys, in cases of caries of the bones, necrosis, or osseous cancer. Professor Virchow has specimens in his most interesting collection which show that metastatic deposits of bone earth have taken place in the lungs and in the stomach, under such circumstances. Considerable portions of the pulmonary tissue were seen to be *calcified* or *petrified*, without any apparent injury to the permeability of the respiratory passages. The lesion in the lung looked like a portion of fine bathing sponge. The mucous membrane of the stomach was in like manner transformed into a *calcified* or *petrified* mass. It felt like a rasp, and grated under the knife, so that the stomach tubes seemed imbedded in a stiffened mass. The basis of such degeneration, in which the lime salts find a resting-place, are the fine fibrous or connective tissues; and hence the degeneration is seen to occur in fibrous

tumors, in serous membranes, in the parenchyma of lungs and stomach (as in the instance just mentioned), in cicatrix tissue on the skin, in the valves of the heart, in the connective tissue of muscle sheath, as well of the heart as of common muscle; in the tunica albuginea, in the fibrin coagula in the heart's cavities, in aneurismal sacs, in the thyroid and pineal glands. The cretifications of fibrin, of pus, of tubercle, of cancer, of vegetations, of coagula, all pertain to this form of degeneration; and the process may be traced through all stages of progressive degeneration from the pulp-like condition to cement-like, compact, calculous concretion, as in the phlebolite of veins; also in the turbid chalky, speedily condensing juice of the cysts of the choroid plexus, and the cell incrustations of the pineal gland concretions, as well as in the calcification of sarcomata and cancers. With regard to the degeneration as seen in tumors, Mr. Paget describes two methods by which it advances, namely, a *peripheral* and an *interstitial* calcification. The former is the rarer of the two. In this form of degeneration the fibrous tumor is seen to be coated with a thin, rough, nodulated layer of chalky or bone-like substance. In the interstitial form the degeneration is interspersed throughout the tumor, and so arranged that by maceration a heavy hard mass is obtained, variously knotted and branched, like a lump of hard coral. (Paget, *Surgical Pathology*, vol. ii., p. 139.)

(c) *Pigment Degeneration—Pigmentation.*

In this degeneration *pigment* takes the place of the minute tissue elements, as fat or lime did in the previously described conditions. It is seen in mucus corpuscles, as in catarrhal pneumonia, in the pulmonary epithelium, in the acini of the liver, in the epidermic tissue, in the corpuscles of the blood in ague and melanæmia. As in the former degeneration, so in this one, a distinction must be carefully made between fat granule cells and pigmentation, for in both cases apparently the same image is offered to view.

The fat granule cells appear as brownish yellow corpuscles, but their individual particles have no positive colour; whereas the pigment cells contain unquestionable grey, brown, or black molecules of pigment, which are opaque (VIRCHOW). The diagnosis between the two is important, as in the brain, for example, where both sorts of granule cells—namely, pigment cells and fat

cells, may exist side by side. The former points to apoplexy having existed, the pigment originating probably in a solution of the hæmatine; the fat to cerebral softening. Therefore it is of importance for the pathological interpretation of the diseased condition to distinguish between pigment and fat in the granular form. Such pigment or colouring matter is insoluble in potash and acids, even in nitric acid.

In mucus corpuscles or catarrhal cells the pigment exists in the form of greyish-black granules. They give rise to the smoky grey spots which are brought up in great quantity in the sputa of catarrhal states of the pulmonary passages; and to an extreme degree where accumulating masses of proliferating epithelium takes place, as in catarrhal pneumonia and in the phthisis of colliers, so well described by Dr. Wm. Thomson. (*Med.-Ch. Trans.*, vols. xx. and xxi.)

In the condition known as *melancæmia* (which, like *leukæmia*, has cells circulating in the blood, having made their way into it from definite organs) the cells contain black pigment; in the latter case (*leukæmia*) the cells are colourless. In *melancæmia* coloured elements are met with in the blood which do not belong to it (STIEBEL, VIRCHOW, SCHONLEIN, HEINRICH, MECKEL, FRERICHS, and TIGRI). These pigment cells in the blood were first seen to occur in the history of melanotic tumors, and were supposed to be due to the passage of particles from the tumors into the blood. This is not yet verified by observation. On the other hand, it is to enlarged spleens pervaded by black pigment that the change in the blood is to be ascribed in such cases, the colour being due to the absorption of coloured particles from the spleen. The class of cases which are the most fruitful source of black pigment in the blood are those of malarious diseases, *e.g.*, *intermittent fevers*, and especially in persons who have been long afflicted with a considerable enlargement of the spleen. In such cases Virchow found in the blood of the heart cells containing such pigment; and the cells that bore the colour resembled in size and form the colourless blood corpuscles; but there were also other cells of an oblong form and nucleated, within which a greater or less number of large black granules were to be seen. It is in the more severe forms of intermittent fever that such pigment degeneration occurs. Such pigment is seen to accumulate in the minute capillaries of the brain, attaching to the points of

division of the small vessels, and sometimes associated with the comatose and apoplectic forms of intermittent fever. Such pigment is also seen in the minute hepatic vessels (FRERICHS), where it ultimately gives rise to atrophy of the parenchyma of the liver. In a specimen of liver dissected and preserved at Fort Pitt, deposition of melanotic pigment in a granular form is seen amongst the interlobular connective tissue, following mainly the course of blood-vessels in an irregular manner; and this case, like all the others yet recorded, was associated with a large black spleen; and the contamination of the blood in these cases seems due to a degeneration commencing in the spleen.

In *post-mortem* lesions the textures are thus seen to be very variously tinted, red, yellow, brown, green, or black, generally resulting from chemical alteration in the colouring matter of the blood or bile. The red pigments, as a rule, are due to the altered hæmatine, which is originally of a yellow colour. It is the common origin of three different kinds of crystals,—(1.) Crystals of *Hæmatoidine* are the most frequent products of blood degeneration (VIRCHOW). These are formed spontaneously in the body out of hæmatine; and in their most perfect form present the shape of oblique rhombic columns, of a yellow red colour, or, in thicker pieces, of a deep ruby red. In little plates it frequently bears a considerable resemblance to uric acid. In the majority of cases the crystals are of extreme minuteness—difficult to resolve, even with a power of 300 diameters. They are insoluble in alcohol, ether, dilute mineral acids, and alkalies; and exhibit a peculiar play of green, blue, rose-tint, and yellow colours, under the action of concentrated mineral acids. If large masses of extravasated blood continue to lie for any length of time, this is the substance into which the blood is transformed. An apoplectic clot in the brain, for example, is repaired by a large portion of the blood undergoing this transformation, and the colour of the resulting cicatrix is due to the crystals of *hæmatoidine*. When a young woman menstruates, also, the cavity of the Graëfian vesicle, from which the ovum escaped, becomes filled with coagulated blood, and ultimately *hæmatoidine* crystals are the last memorials of the event (VIRCHOW). *Hæmatoidine* is also allied to the colouring matter of the bile.

The second form of crystals arising out of *hæmatine* differ from *hæmatoidine* in this, that they must be artificially produced;

they do not occur in the body. They are of a dark-brown colour, and have been named *hæmine*.

The third form consists of rectangular crystals or spicules of *hæmato-cystalline*.

The yellow pigments are due to blood very much dissolved or dispersed, as in ecchymosis, or to bile, when it is absorbed in the blood and tinges all the textures. Such colouring matter may be recognized in the urine by the play of colours it gives with nitric acid. A small quantity of acid gives a green hue; and as more acid is added, blue, purple, violet, and a red or brown yellow colour will ultimately appear. Of the brown and dark pigments there are two kinds. One kind loses colour on the addition of nitro-muriatic acid or chlorine water; the other resists not only these agents, but even the action of the blow-pipe. This latter pigment consists of carbon. The former is a peculiar secretion formed within cells, or is a transformation of the colouring matter of the blood (BENNETT). Blue and purple pigments have been seen in urine containing *uroxanthin*, or the *Indican* of Schunk; and is an instance which illustrates the close connection subsisting between animal and vegetable colouring matters. (Parkes *On Urine*, p. 198.) For much more interesting observations on the nature of pigmentation, consult Bennett's *Principles and Practice of Medicine*, p. 249.

(d) *Amyloid or Albuminoid Degeneration.*

This morbid process is one in which the normal textural elements of many organs and tissues are transformed into a peculiar substance, which has suggested, on the one hand, an alliance, in some respects only, with the chemical characters of amyloid compounds, and, on the other hand, with albuminous substances.

Professor Virchow, of Berlin, was the first to collect the facts regarding this peculiar form of disease, and to put them prominently forward. He proved the frequent occurrence in the animal economy of a general morbid process, distinguished by the production of the peculiar substance to be described, which gradually takes the place of normal elements in the tissues so diseased. But Drs. Gairdner and Sanders, of Edinburgh, had anticipated many of the views and descriptions of the Berlin Professor, and, quite independently of Virchow, they initiated in

this country the first steps in the elucidation of this very remarkable degeneration. They showed that the waxy condition of the liver and kidney was due to the same change as that which was seen to take place in the spleen. These valuable communications were made to the *Physiological Society* of Edinburgh; and an account of them may be read in the *Edinburgh Monthly Journal of Medical Science* for Feb., 1854, p. 186, and also in May of the same year. Notwithstanding these researches, and those of Drs. Harris, Alridge, and others in this country, we have much still to learn regarding, (1.) The conditions under which this degeneration occurs; (2.) The forms in which it exists; and (3.) The symptoms of the lesion.

This degeneration has been long known by a variety of names. For many years the morbid anatomist has been familiar with what he described as a "bacon-like," or "lardaceous" infiltration of several solid organs of the body, and especially of the spleen and the liver.

Portal and Abercrombie described the morbid condition in the liver as a "*lardaceous degeneration*;" and Hodgkin and Bright described the same disease as an "*albuminous infiltration*." In 1842 Rokitansky was the first to give a clear account, and to describe in detail the "*lardaceous*" infiltration of the kidney with an "*albuminous*" transparent substance. The lesion so described constitutes his eighth form of "Bright's disease." But Rokitansky made no chemical examination of the infiltrated material. He simply assumed, from its general appearance, that it was of an *albuminous* nature, and he rightly recognized its pathogenetic relations to certain cachexiæ. Budd has described the disease as "*scrofulous enlargement of the liver*." Oppolzer and Schrant have described the lesion by the name of "*colloid*," and Baron by the name of "*carnification*." The pathologists of this country have hitherto described organs so diseased under the term of "*waxy degeneration*."

Such are the names, derived from appearances generally, under which the peculiar degeneration has been described before microscopic examination demonstrated the structures implicated.

Chemistry and micro-chemical investigations have also modified the views regarding the nature of the disease, and now and then have led to modifications in the nomenclature. Under this kind of inquisitive investigation it has been described, (1.) By Virchow

under the name of "*animal amyloid*," he believing, from the behaviour of the transformed substance with iodine and sulphuric acid, that the substance must be classified with the vegetable carbo-hydrogens—cellulose and starch. (2.) Meckel retains the name of "*lardaceous*" or "*cholesterine disease*," believing that the essential character of the degeneration consists in the development of a peculiar fatty or lardaceous matter, of the nature of cholesterine. (3.) More extended and definite examination by Friedreich and Kekulé have shown that the substance of the purest amyloid degeneration more closely resembles the *albuminous principles* than any other substance we know of; and (4.) Schmidt has arrived at the same conclusion. The question, therefore, is not yet definitively settled as to the exact nature of the substance into which the tissues are transformed in the so-called *amyloid degeneration*. The albuminoid deposits in the spleen of children, so well described by Dr. Jenner, must be classed as examples of this degeneration.

Investigations relating to amyloid degenerations have taken especially two directions. Pathologists have endeavoured, (1.) To trace the extension of the process of degeneration throughout various tissues and organs of the body; (2.) To determine the essential nature of the material into which the tissue is converted.

It was Professor Virchow who first turned the inquiry into the direction it has now taken, and which has given a remarkable interest to the micro-chemical investigation of the substance into which the minute elements of the tissues and organs are transformed in amyloid degeneration. Virchow stated that the large Malpighian sacculi in the spleen (which, in some instances, looked like boiled grains of sago) were sometimes composed of a substance which gave the chemical re-actions of cellulose, as seen in plants. Cellulose and starch are both vegetable constituents—"isomeric" forms of some common material; and what gave special interest to the observation of Virchow was the discovery that cellulose is also an element in the covering or skin of the "Tunicata"—a genus of acephalous mollusca—and therefore not a constituent of only vegetable organization.

This discovery of cellulose in animal tissue induced Virchow to look for it or its analogue—namely, "starch"—in the human subject. He recognized it in the *corpora amylacea* of the brain.

These contain a substance chemically related to starch or cellulose; and these bodies were first seen and named by Purkinje, who gave them the name they have, not on account of chemical characters, but because he observed them to be laminated like starch. Of these *corpora amylacea* there are two kinds, namely,—(1.) Mineral bodies with concentric circles more or less soluble in mineral acids; (2.) Others which assume a blue tint with iodine, and a violet colour on the subsequent addition of sulphuric acid. The relations of these two kinds to each other are still unknown. The first are the calcareous particles known as brain sand; and *both* were at first described under the name of "*corpora amylacea*" by Virchow, which has led to some confusion. The term ought to be restricted to those bodies which, by physical and chemical characters, are assimilated to starch. The mineral bodies erroneously described as *corpora amylacea* are chiefly found in the cysts of the choroid plexus and in the pineal gland. On the other hand, the starch-like bodies have been found by Virchow, Rokitansky, Scherer, Kölliker, Busk, and other observers, in the *ependyma* of the ventricles, the *septum lucidum*, the *fornix*, the *auditory*, and the *optic nerves*; and also in the *prostatic ducts*. Concentric lamination of these bodies is not always present; nor is the re-action with iodine and sulphuric acid constant. For these reasons Virchow began to examine those organs whose morbid state was described by the names already mentioned as having been given to fatty or waxy spleen. He applied solutions of nitric acid, which, when hot, gave a yellow hue; he applied caustic ammonia, which gave a brown colour; and from behaviour with re-agents generally he concluded that the substance was "ALBUMINOID" in its nature. Iodine and sulphuric acid were subsequently tried. Iodine alone gave a strong yellow red; sulphuric acid being added, developed a blue colour, passing into a strong violet hue. An excess of acid destroyed the violet hue, causing a dark-brown red colour, passing into yellow. Meckel, subsequently to these observations of Virchow, came to the conclusion that there were four forms of this waxy material—that the basis of them all was a peculiar fat, allied to cholesterine rather than to starch—that various saponaceous products are formed, ending in the development of cholesterine; and although he did not sustain his statement by anything like sufficient proof, he made the important discovery that it was

the system of small arteries and capillaries which first suffered in this degeneration.

The inquiry into the chemical nature of the lesion becomes still more interesting when connected with the observations and discoveries of Bernard, Pavy, and others, on the "sugar-producing" functions of the liver, and on the material so formed, which may be separated by chemical processes. The results of these inquiries bring the "starchy substances" of animals in very close physiological alliance. The material so found has been called indifferently, "glycogene," "amyloid matter," "zoo-amyline," or "animal starch." It owes its origin, not to any direct function of the organ, but its formation seems to take place almost immediately upon contact with albuminous matter; and then this remarkable product is the result which may be obtained as a white powder. It seems capable of being produced in greatest abundance by the hepatic tissue; but its formation may proceed at any part of the vascular capillary system. If, therefore, it is thus formed normally, it may also be formed, retained, or transformed in a morbid way. In *diabetes* we have an instance of the transformation of the product into sugar, at the expense of the tissues at large, and so discharged by the urine.

The amyloid degeneration we are now considering has thus had various names to denote its presumed chemical nature, namely,—(1.) *Cellulose degeneration*; (2.) *Amyloid degeneration*; (3.) *Cholesterine disease*; and now (4.) *Albuminoid degeneration*. Still opinions are varied and unsettled.

The analysis of the pure matter is very defective. Such as it is, it shows the substance to be *albuminoid*, and combined with *nitrogen* rather than *starch*; and those who describe the re-action of *cellulose* and *starch* with iodine and sulphuric acid, seem only to agree with each other in giving singularly diversified descriptions of colour, which perhaps, to those familiar with the writings of the late Dr. George Wilson on colour-blindness, may be easily accounted for. Such diversity may be explained in some measure, also, by the fact that the degree of concentration of the re-agents materially concerns the results; for, as Virchow correctly observes, the blue coloration is only got after a considerable period, and in practised hands, and it may pass from a bright purple to a very blue colour. Nevertheless, the action of iodine

solution on amyloid tissue is peculiar and definite, independently of a blue colour.

The appearance of a chemical re-action, which gives a hue different from the mere dyeing with the iodine, and which *suddenly* deepens in tone from the moment it begins to take effect, to a deep brown-red colour, is sufficiently characteristic. When this takes place with the solution of iodine *ALONE*, it distinguishes at once the substance from *cellulose* and *cholesterine*. The following tabular statement will show the differences more clearly:—

CHOLESTERINE.	AMYLOID OR ALBUMINOID.
1. Unchanged in colour by iodine alone.	1. Immediate coloration (of the nature of a re-action) by iodine alone.
2. Insoluble in water.	2. Dissolves in warm or boiling water. (Boil sections in a test tube.)
3. Melts with heat.	3. Do not melt with heat—only dry up, and still give the same re-actions with iodine.
4. Passes into a brown fluid on the addition of sulphuric acid <i>concentrated</i> .	4. Swell in, but do not dissolve with sulphuric acid, with change of colour.
5. Soluble in ether.	5. <i>Not</i> soluble in ether.

By way of chemical analysis very trustworthy results seem to have been arrived at by Friedreich and Kekulé. On submitting the white amyloid matter to ultimate analysis they obtained the following composition in equivalents per cent. (*Med.-Ch. Review*, 1861, p. 59):—

	C.		H.		N.
<i>Amyloid</i> ,.....	= 53·58	.....	7·0	.....	15·04

Now, the composition of albumen, according to Dumas and Cahours, Lieberkühn and Rüling, is as follows:—

	C.		H.		N.
<i>Albumen</i> ,.....	= 53·5	.....	7·1	.....	15·8
Dumas and Cahours,	{ 53·4	.....	7·2	.....	15·7
	{ 53·5	.....	7·3	.....	15·7
Lieberkühn,.....	53·5	.....	7·0	.....	15·6
Rüling,.....	53·8	.....	7·1	.....	15·5

Surely these results show an almost perfect chemical identity between albumen and the morbid substance found in the so-called waxy spleen; and demonstrate that the waxy degeneration, in the spleen at least, is due to a peculiarly modified

albuminous material, and not to starch? The chemistry of the corpuscular variety of *corpora amylacea* occurring as a deposit in various parts—*e. g.*, in the brain, the prostate, and the *ependyma* of the ventricles—shows a re-action almost identical with starch. The corpuscles also have concentric laminæ, and, according to some, resemble starch granules when polarized. As regards the corpuscles of the prostate, sugar has been chemically produced from them, and demonstrated by Trommer's test.

Many of these corpuscular varieties of amylaceous bodies are no doubt of the same nature as starch; and therefore the direction which inquiry ought now to take will be to determine "Whether or not there is any chemical affinity on the part of the formless matter of waxy degenerations with the corpuscular variety of the amylaceous concretions?" Such an affinity has been assumed hitherto; but so far as observation has gone, the evidence of any affinity seems to be getting less and less. On the other hand, the modifying effects of admixture and of growth are very remarkable as regards these prostatic concretions. *Some* of them *iodine* will not colour blue, not even after sulphuric acid has been added; and as growth proceeds, any amyloid matter they contain gradually disappears. Many admixtures of organic and inorganic substances give various shades of colour; and the yellow-brown coloured deposits failed to give forth sugar to Paulizky's attempts.

General Characters and Anatomical Description of Tissues which have undergone Amyloid Degeneration.—The cut surface of an organ so affected has a semi-transparent appearance. It feels like a piece of soft wax, or of wax and lard combined (WILKS). It cuts into portions of the most regular shape, with sharp angles and smooth surfaces; and the thinnest possible slices may be removed by a sharp knife, for microscopical examination. They are abnormally translucent. Water and alcohol, acids and alkalies do not produce any change upon the transformed parts, which may be kept for a length of time without decomposition. The organs affected are increased in volume, in solidity, and in weight, absolute and specific. Anæmia is predominant; but the colour of blood or of healthy tissue shines through the semi-transparent morbid substance.

Amyloid degeneration is generally widely diffused; so much so, that a constitutional state of ill-health seems associated with its production; and in cases preceded by a local disease, such as

caries of a bone, the degeneration may only be found in the adjacent lymphatic glands (BILLROTH). This is the earliest appearance of the degeneration yet recognized.

The small vessels of the tissue—the more minute arteries in particular—are, as a rule, the first structures attacked. The coats of the arteries become thickened and granular, and at last pellucid, transparent, and hyaline. Their caliber is reduced, and their cut section remains patulous.

The cells of the functional parenchyma next undergo the change, which finally spreads to the vessels amongst the connective tissue.

It is the middle or muscular coat of the vessels which first changes. Each fibre cell becomes a compact hyaline, pellucid, transparent particle, with an indistinct outline, and all the tissue involved becomes at last uniform, clear, and transparent. The degenerate artery looks like a compact, homogeneous, silvery cord or thread, of a clear and glassy appearance, with a lustre like molten glass without polish, or like rough ice. This colourless, hyaline, degenerate tissue is very tough, but not hard nor brittle, like the calcareous degenerate parts. All other degenerations tend to obscure the original texture, by making it more opaque. This degeneration, on the contrary, renders the affected tissue more transparent and pellucid. It is in reality a “hyaline degeneration.”

When a solution of iodine is brought in contact with the affected part a very deep violet-red colour is produced; and this deep red colour seems to be *alone* a sufficiently characteristic test, especially when in a few seconds the colour increases in depth from the moment it takes effect. It is a re-action which ensues between the iodine solution and the morbidly degenerate part. The best solution test is composed as follows:—*Twelve grains of Iodine* is to be dissolved with *twenty-four grains of Iodide of Potassium*, and mixed with *three ounces of Water*. Such a test solution ought always to be at hand in the dead-house, or on making a *post-mortem* examination.

Elements of Tissue in which Amyloid Degeneration has been demonstrated.

1. Nervous System:—ligamentum spinale cochleæ: atrophied parts of brain and spinal cord: gelatinous softening, and tumors.

2. Spleen:—cells of the Malpighian sacculi and pulp: thickened walls of the arteries in all stages: the trabeculæ.

3. Liver:—the cells and intralobular vessels (hepatic arteries): intercellular tissue.

4. Kidneys:—Malpighian sacculi and afferent vessels, the walls of which become enormously thickened: areolar tissue in the vicinity of the papillary ducts.

5. Muscular tissue of the heart and the uterus.

6. Villi and mucous membrane of the alimentary canal.

7. Osseous tissue.

8. Lymphatic glands.

9. Besides the original structures of the body, old deposits in serous membranes, having lost their fibrous character, becoming dense, more vascular, and semi-transparent, undergo this metamorphosis (GAIRDNER).

10. Tubercle also becomes amyloid (GAIRDNER).

11. The cancerous nodules in a waxy liver also become amyloid (GAIRDNER).

12. In some cases of inflammation with exudation on the mucous membrane, the exudation has assumed the amyloid degeneration (VIRCHOW).

13. The fibrine of a hæmatocele (FRIEDREICH).

The very extensive range of organs in which this very remarkable degeneration has now been demonstrated clearly shows that the lesion cannot be regarded as merely of local importance. Its occurrence seems rather to point to some general pathological state of which the degeneration is the expression. In the first instance it is found more particularly affecting the functional capillaries of the most important organs of the body—*e. g.*, the kidney, the liver, the spleen, the intestines, as well as the minute arteries of nutrition of those organs, and of the pia mater, bone, and lymphatic glands. The results of such a degeneration must therefore be sooner or later destructive (1.) to the function of the invaded organ, and (2.) to its nutrition; and we can only arrive at a correct pathology of this degeneration by a close observation of the circumstances, condition, relations, and symptoms under which the lesion manifests itself. These must be studied especially in relation to the functional or physiological anatomy of the organs implicated. As yet the lesion has been recognized with certainty only in the dead-house. There it has been found associated with certain diseased states; and all the cases agree in this particular, namely, that the constitution of the patients has been

broken up by ill-health (cachexia) of some considerable duration before death. So it has been amongst the soldiers dissected at Fort Pitt; and the following statement is a summary of diseased conditions in the order which furnishes the greatest number of cases of amyloid:—

Diseased States with which Amyloid Degeneration has been found associated, or upon which it is engrafted,—

1. *Diseases of the bones*, especially caries and *necrosis* in scrofulous subjects. *Rickets* also leads to the amyloid liver and spleen, as observed by Glisson, Portal, Rokitansky, Lambe, Loeschner, Frerichs, and Jenner.

2. *Constitutional syphilis*, and especially in its ulcerative forms. Syphilitic children have been the subject of it when newly born.

3. *The malarious cachexia*, and especially *intermittent fever*.

4. *Mercurial cachexia* and *marasmus*.

5. Pulmonary and intestinal forms of *tubercle*.

6. *Albuminuria* and *anasarca*.

7. *Diseases of large arteries*.

As to the origin of the lesion or degeneration, Frerichs has propounded two questions, namely,—(1.) Is the lesion due to deposits from the blood of the amyloid, waxy, or albuminoid matter in some primordial form, and which is generated in the blood, in consequence of a local disease, such as caries of the bones? (2.) Is the amyloid or waxy matter developed locally in the affected tissue by the transformation or degeneration of albuminous matter previously deposited?

Arguments are put forward by Virchow and Frerichs to show that the lesion may be due to a deposit from the blood; but the weight of evidence seems, on the whole, to point to a peculiar degeneration of existing tissue. For, (1.) In cases where the lesion follows affections of the bones, the lymphatic glands adjoining the diseased bones are implicated before the kidneys, liver, or mucous membrane of the intestines. (2.) General causes of ill-health (cachexia), pointing to impoverished blood, are in operation, and organs situated in different parts of the body are simultaneously affected. (3.) The fibrin of the blood itself has been observed to undergo the degeneration; for Friedreich found a substance which gave the amyloid re-action with iodine in the old fibrinous layer of the sac of a hæmatocele.

In this remarkable degeneration an acquaintance with a n

fact in pathology must be recognized—*i. e.*, since 1854—associating itself with grave constitutional disease, and distinguished from every other morbid condition hitherto known, by the physical, chemical, and physiological characters just described.

The Clinical History of amyloid degeneration is remarkably deficient as yet. The effect of the degeneration is to interfere with function of organs and nutrition of parts. For example, hepatic cells cease to take part in the formation of sugar or the secretion of bile. Blood-vessels lose their power of transmitting fluid through their walls, and become impervious as to their canals; and the injurious effects are the more marked as the degeneration extends through many important organs. Hence those who suffer from amyloid disease have an appearance of *general ill-health*, denoted by paleness of the surface, by symptoms of anæmia, hydræmia, or by leukæmic affections of the blood; and the more so as the constitution is enfeebled by such morbid processes as ulceration of bones, syphilis, tuberculosis, or malaria. The sequence in which the different organs degenerate is uncertain. In most cases of caries and necrosis the kidneys seem to be first attacked after the lymphatic glands. In cases of intermittent fever it is usually the spleen which is first affected; and generally it seems rare to find several, or all organs affected to the same extent.

Signs or Symptoms associated with this Degeneration, discoverable during life.—On these points, also, data are wanting upon which to found any statement. The pathological change is of so recent discovery that well-recorded cases, terminating in death, with verification of the symptoms during life by *post-mortem* inspections, have not yet been obtained. There is no subject, therefore, more full of interest, or one more likely to repay close observation and well-directed pathological inquiry than the diagnosis of amyloid degeneration. Cases in hospital ought to be most carefully noted, and especially such ambiguous cases as those where marasmus, anæmia, or dropsy are *primary* symptoms, and which are not to be accounted for even after the blood has been examined microscopically during life, and the condition of the liver, heart, spleen, and lymph glands carefully inquired into, without evincing signs of disease. In a remarkable case recorded by Friedreich and Kekulé, and quoted in the *Medico-Chirurgical Review* for October, 1860, *diarrhœa* and *vomiting* were of frequent occurrence, with a systolic murmur of the heart,

high-coloured and albuminous urine, with a specific gravity of 1·019. The patient was a female, who had suffered from tertian ague for twelve months, and became dropsical and emaciated. The intestines throughout, the stomach, the colon, the jejunum, and especially the capillary vessels of its villi, were affected, as well as the vessels of the kidneys. The urine should be watched as to albumen, or deposits, and its amount in relation to body weight should be recorded. When albumen appears it goes on gradually increasing; and hyaline casts also increase with the increase of albumen. Dr. Parkes tells us that "roundish bodies, with concentric layers, which give a peculiar violet colour with iodine and sulphuric acid, have been noticed by two or three observers." (*On Urine*, p. 211.) He considers it probable that they may indicate the amyloid degeneration. But may they not come from the prostate gland? The calculi or concretions so abundant in the prostate have such a re-action; and we have no evidence of amyloid masses separating during life from the tissue of the kidney. Were such to be found, they could only be the glomeruli of the kidney, capable probably of identification.

Dr. Stewart, of Edinburgh, records cases, *but no dissections*, where he considered amyloid degeneration to have been present. (*Edinburgh Medical Journal* for February, 1861.) He records that large quantities of urine were passed in the early stage, of supposed waxy degeneration, and of a specific gravity from 1·005 to 1·015. For a detailed account of "amyloid degeneration" in the various organs, see the description given under LOCAL DISEASES. The degeneration is much more common than is generally supposed. It has been observed very frequently amongst the soldiers who have been dissected at Fort Pitt. The microscope and iodine test can alone determine its absence; and without microscopic examination the absence of the degeneration cannot be determined.

Before stating the principles which dictate the treatment of the complex morbid processes just described, and of the individual diseases in particular, it behoves the student, first, to make a separate study of *the varying types of diseases, their prevailing peculiarities, and the constitutional tendency to change of type which they assume* at varying intervals of time; and, second, to observe and learn to recognize *the various modes by which diseases terminate fatally*.

CHAPTER VIII.

TYPES OF DISEASE AND THEIR TENDENCY TO CHANGE.

IN describing, appreciating, or ascertaining the type of a disease, our attention must be directed to a variety of phenomena and conditions; and the type of the disease only becomes characteristic and distinctive when some one or other of those conditions becomes predominant, or manifests itself more decidedly than others. The hereditary or natural constitution of the individual may be regarded as an important element in determining the type of the disease. Town life, as compared with country life, also exercises an influence; and there are good grounds for believing that the town life and artificial habits of the present period are more prejudicial to the strength of the constitution than those which prevailed when large towns were but rural villages, the inhabitants more simple in their mode of life and less artificial in their habits.

The occupation of the individual also in many instances exercises an influence over the complex processes of disease. The social habits of the age are very much different from what they were wont to be. Society is now more disposed "to exercise a rigid temperance in all that concerns life. The human constitution cannot now bear with impunity and safety a great amount of stimuli and mental work. This was not the case in those halcyon days when men were recognized as being two, three, four, or five bottle men. This change may be attributed to the social habits of the age; but, to some extent, may not those altered and temperate habits arise from a consciousness of our inability to live above par, as men were accustomed to do thirty or forty years back?" (WINSLOW).

Further, there cannot be a doubt that some diseases have altogether disappeared, while others have been so much modified that their resemblance to the original form or type can with difficulty be recognized.

With regard to Edinburgh and its vicinity, Dr. W. T. Gairdner observes that the *changes of type* which have occurred in epidemic fever, and especially in typhus fever, during the ten years pre-

vious to 1862, or since the cessation of the great epidemic of 1847-8, are not less remarkable than the diminution in the amount of this class of cases. The *relapsing fever*, or *synocha*, which formed so large a part of the epidemics of 1843-4 and 1847-8, has for the time absolutely disappeared. *Typhus fever* has become less fatal to those attacked than it was ten years ago; while its general type, and some of its leading characters, have been remarkably modified. This is especially noticeable in the *diminished mortality*; the *earliness of the appearance of the eruption*; the *earliness of the crisis* (tenth to fourteenth day as a rule, and rarely prolonged into the third week)—a great cause of the diminished mortality, for a day's delay of the crisis, in a case of any degree of severity, is an immense addition to the risk. (*Clinical Medicine*, 1862, p. 156, *et seq.*) Nevertheless, it is the rule that diseases preserve their essential characters and nature from age to age, although the opinions of the profession respecting them and their treatment may change from year to year, or from one period of time to another. For example, *small-pox*, *measles*, *typhus fever*, *typhoid* or *intestinal fever*, *dysentery*, *diphtheria*, and the like, always remain the same as to their essential characters, and unchanged in their special symptoms; but it must be remembered that they are also very often modified in their phenomena by the existence of such constitutional ill-health (*cachexia*) as may arise from *syphilis*, *mineral*, *vegetable*, or *alcoholic poisoning* of the system, from *gout*, *rheumatism*, *scrofula*, *tuberculosis*, *scorbutus*, and the like, as well as from epidemic causes still unknown. Diseases also have arisen which appear to be more or less new to us, in some instances resulting from a hybrid combination of various pathological phenomena to be noticed presently. While this is undoubtedly the case, there is abundant evidence to prove that we now have a more healthful enjoyment of our life on the whole (although the constitution may not be so strong) than in those so-called halcyon days; and that the duration of man's life of late years has been, on the whole, prolonged. While it is the lot of "all men once to die," that final change is now much more frequently deferred, than was wont, to beyond that period when, in the words of the inspired Psalmist, it is recorded that "the days of our years are threescore years and ten; and if by reason of strength they be fourscore years, yet is their strength labour and sorrow."

It has been observed by a popular writer that there never were any specifics discovered against the *plague*, the *sweating sickness*, or the *leprosy*, and yet these diseases, as far as regards this country, are now amongst the things that were, and are almost unknown. They have disappeared, not before any marvels of medicine, or any perfection of chemical sciences, but before the gradual amelioration of our condition through sanitary improvements. Observe, also, what sanitary science has done, in a comparatively short space of time, to ameliorate the condition of the British army. The Right Honourable the Secretary of State for War (Sir George C. Lewis, Bart.), in moving the army estimates for the year 1862 in the House of Commons, said,—

“Improvements have been introduced with a view to ameliorate the social, moral, and sanitary condition of the private soldier. Much expenditure has been incurred for the sake of enlarging and improving barracks, and in carrying out various recommendations of the House of Commons, with respect to barracks and the hospitals connected with them. I am happy to say,” continues the Right Hon. gentleman, “that these efforts have not been unattended with important results, as will appear from authentic returns of the mortality in the service. These returns have been prepared by the Director-General of the Army Medical Department, and I believe they are perfectly authentic, though it is certainly difficult to believe that so great a change can have taken place in so limited a period. It is possible that the greater youth of some portions of the army may, to a certain extent, affect the returns, but I believe the difference is mainly to be explained by improvements in the sanitary conditions under which they are now called on to serve.

“Deaths among the Troops serving in the United Kingdom annually per 1,000 of men.

	From 1830 to 1834.	1859 to 1860.
Generally throughout,	14	5
Cavalry of the Line,	15	6
Royal Artillery,	15	7
Foot Guards,	21	9
	From 1834 to 1844.	1859 to 1860.
Infantry of the Line,	17	8

“Similar Returns for the Colonies are as follows:—

	From 1837 to 1856.	1859 to 1861.
Gibraltar,	22	9
Malta,	18	14
Ionian Islands,	27	9
Bermuda,	35	11
Canada,	20	10
Jamaica,	128	17
Ceylon,	74	27

"I have other returns from other colonies," continues the Right Honourable gentleman, "and I believe that these returns are authentic, and certainly they show how very considerable a diminution has taken place in the mortality of the army." (*Times*, March 4, 1862.)

The late Lord Herbert was the main agent in accomplishing this great work, which, as years pass on, will become better known and followed up.

Dr. W. T. Gairdner happily observes, that in proportion as we are getting rid of the severer forms of epidemic disease (*e. g.*, fever, dysentery, scurvy, influenza, all more or less preventible), which had deteriorated the health of the population previously to 1848, we are also getting rid of the more severe and unmanageable types of acute inflammation. Inflammatory diseases, like fevers, he therefore justly considers to be subject to epidemic causes of increase and diminution, both as regards frequency and severity; and he believes that the acute inflammations are nearly as much under the influence of the sanitary reformer as the more obviously epidemic fevers; and further, that some even of the chronic organic diseases have already yielded, and may be expected still further to yield, to the improved habits, the better clothing, the greater abundance of food, and the diminished destitution of the population generally. (*Clinical Medicine*, p. 42.)

The art of medicine, guided by sanitary science, must now, therefore, be regarded as a productive art; for by diminishing the occurrence of preventible disease, and thereby lessening mortality, the average duration of human life has been extended to an age nearer that which has been ordained for man. Nevertheless, as physicians, it behoves us to remember that the sphere of our professional exertions is limited, and surrounded by insurmountable barriers; and that death will eventually come alike to all, "reminding us that we ourselves must become victims to the incompetency of our art."

Dr. Pollitzer, of the Children's Hospital at Vienna, is of opinion, that while the duration of mortality at early ages is diminishing in all civilized countries under the various influences of extended hospital accommodation, care of the sick, vaccination, and general sanitary regulations, there is no corresponding increase in the strength and vigour of the human race. On the contrary, the boundaries between health and disease are thus becoming less and less marked. There are now to be observed

numerous conditions which are undoubted deviations from the healthy standard, which it is impossible to delineate or accurately to define, because they make their appearance during a state of "*relative health*." The physician is not always even able to name the disease; and while the patient maintains that he is not feeling in health and not looking in health, but wasting away, his food doing him no good, he has no alternative but to call himself ill. Such is the insidious mode in which many of those truly CONSTITUTIONAL diseases and DEGENERATIONS, now so common, make their appearance, and which may be regarded as constituting a peculiar characteristic in the pathology of our times. These diseases are known by the various names of *anæmia*, *spanæmia*, *leucocythæmia*, *chlorosis*, to which we must now add such degenerations as those described in the previous pages, as "amyloid degeneration," "pigmentation," "fatty degeneration," and the ill-health (*cachexia*) of malaria, and of syphilis.

The poorness of the blood, peculiar to the class of diseases mentioned, furnishes the soil in which the feebleness and deterioration of our race is most unmistakably evident. The nervous system is, moreover, extensively involved in the diseases of the age, and thus feebleness and debility constitute their dominant character. This physical deterioration is apparently a "*sad memorial of modern civilization*." In this respect the observations of Dr. Pollitzer coincide with those of Dr. Forbes Winslow. "A constant stretch of the mental powers, a restless excitement of the passions, a perpetual struggle for advancement, the fresh wants of every day (science, and the arts themselves, being subservient even to the luxury and demoralization of the times), the destruction of all moral harmony and peace, are evils which undoubtedly prevail, and which re-act especially upon the younger generation." The sins of the fathers are undoubtedly being visited upon the children in these days, and are likely to continue to be so. The demands made upon the youth of eighteen or twenty of the present day would formerly have been considered a sufficient tax for the strength of a man of upwards of five-and-twenty. Many of the features, also, which characterize the pathology of our age have arisen out of the treatment of infancy and childhood; and much of the deterioration of the race at large may be shown to date its origin from childhood. Thus, after seventeen years' observation in children's disorders, Dr.

Pollitzer writes that *anæmia* and *chlorosis* occur alone, or associated with *rickets*, *hypertrophy* of the *lymphatic glands*, and of the *spleen* and *liver*, to an incredible extent even from the first month of life. In the Children's Hospital at Vienna, from seventy to eighty per cent. he found to be thus affected. Wherever the nutrition of the child had been imperfect, the constitutional diseases associated with poverty of the blood became widely diffused. The stomach and intestinal tract first suffer, constituting the prevailing morbid condition of childhood—materially influencing the mortality at an early age, and if the age of childhood is survived, affecting the future health of youth and manhood, and doubtless of subsequent generations. (*Med.-Ch. Rev.*, Report on Medicine, p. 261, July, 1857.)

The types of disease are also evidently modified by complication with other diseases, now more widely spread; and the doctrine of the incompatibility of two or more contagious diseases concurring in the same subject has been clearly proved to be erroneous. Dr. Murchison, in an admirable paper on this subject in the *British and Foreign Medico-Chirurgical Review* for July, 1859, has clearly shown the co-existence of *variola* and *scarlatina*, of *variola* and *rubeola*. Dr. F. J. Brown, of Rochester, has recorded a case of *variola* concurring with *measles* and *purpura*. The co-existence of *variola* and *roseola* or *erysipelas*, of *variola* and *pertussis*, of *variola* and *varicella*, of *variola* and *vaccinia*, of *vaccinia* and *scarlet fever*, of *vaccinia* and *rubeola*, of *vaccinia* and *pertussis*, of *vaccinia* and *varicella*, of *rubeola* and *pertussis*, of *variola*, *rubeola*, and *pertussis*, of *scarlatina* and *rubeola*—the *rötheln* of the Germans—of *scarlatina* and *enteric* or *intestinal fever*, of *typhus* and *enteric*, *intestinal*, or *typhoid fever*, have all been more or less clearly shown. Virchow relates a case of typhoid fever, combined with striking symptoms of cholera, occurring at Würzburg. It is now also well known that the paludal poison, and the poisons of syphilis, the plague, the cholera, dysentery, and influenza, are compatible, not only with one another, but with the poisons of those other diseases already mentioned; and the concurrence of any two or more of them in the same person tends to modify, in a remarkable manner, the characteristic phenomena of each. There are also good grounds for believing that as we approach certain well-marked geographical regions of the earth, where characteristic

types of disease prevail, the confines of these disease-realms are found to mingle their types of disease together, so that the diseases of one region merge into and participate in many of the characters peculiar to the other.

Cholera has extended its ravages over the earth, and is now a disease whose germs are endemic in our land; and, consistent with the prevailing medical constitution, the system under its influence, especially in the early cases of an epidemic, becomes rapidly depressed to the speedy extinction of life. The *furunculoid* epidemic which prevailed about six years ago was one of a novel variety, and must be associated with a similar kind of medical constitution. The *black death* of the fourteenth century seems to have revived in India, and is described by the name of the *Indian Pali plague*; and it may be that the formidable disease which laid waste our country in the thirteenth century may have arisen in these districts, and proceeded thence to our land, passing apparently in the same way that cholera has done (DR. ALLEN WEBB).

Our modern treatises on medicine justly and properly deal, largely and minutely, with the descriptions of individual diseases, as far as their nature can be discerned; and the languages of all civilized nations have very clearly described them. Now only are we beginning to profit by an extended inquiry into the diseases of nations; and to find that as man wanders from his native home, the type of the diseases to which he is liable also changes. In this field of science an unmeasurable and still unexplored country extends on every side. The more minutely, also, that individual diseases can be described, the more useful will such descriptions be for comparison in future ages; and it will be seen, on comparing the descriptions of diseases in times past with accurate descriptions of the same diseases now, how, at various periods and under various circumstances, the expression of certain sets of symptoms becomes sometimes strongly developed, while at other times the same classes of symptoms were mild and subdued; but the really essential characters of specific diseases remain as persistent as the specific characters of a plant or an animal.

It will be seen how, in epidemics, diseases have been characterized by the expression of malignant phenomena scarcely perceptible before. The small-pox now-a-days is not the malignant small-pox of the time of Sydenham. Nevertheless, it is

small-pox. And although it may be said that such an example does not illustrate a change in the type of a disease, because the change has been effected by artificial means; yet it must appear evident that, in effecting this change, natural results have only been imitated; and who can tell what modifying influences of a similar kind are going on, although the science of medicine can as yet take no cognizance of them? We know that certain diseases confer immunity on the individual from future attacks; may it not be, therefore, that immunity to individuals from some diseases is conferred by agents and processes of which we as yet know nothing; and that ultimately the types of complex morbid states may still come to be very much changed from what they are now? They certainly appear to be very much changed, according to the best authorities, from what they were forty or fifty years ago. "Many of the symptoms, and particularly the constitutional fever usually attending internal inflammations, and resulting from cold, or from other causes independent of the application of morbid poisons, are liable to variation in like manner, although not so decidedly nor so rapidly as the epidemic diseases, in the course of time, and from causes not yet known. They have in fact undergone very considerable change since the early part of the present century; and it is on this account that inflammations of the lungs in particular are treated with equal success at present, with a much smaller loss of blood than they used to demand" (ALISON).

Such changes in the types of disease were formerly observed and much insisted upon by Sydenham, especially in the progress and recurrence of continued fevers; and it is now a fact well recognized, that not only does the prevalent mode of fatal termination during epidemic diseases vary, but so also do the types, peculiarities, and morbid constitutional tendencies vary in these diseases. It is chiefly with regard to the *local*, *sporadic*, or *intrinsic diseases*, and especially inflammations, such as the *cephalic*, the *pulmonic*, or the *enteric*, that any doubt exists as to whether or not they vary in their type or constitutional tendency. Distinct statements as to this fact, however, have now been made by many accurate observers, whose experience is of the utmost value to science. Dr. Alison and Dr. Bennett both agree as to the fact, "that of late years, and apparently also in different parts of the world, *inflammation*, the most important of all forms of *local*

diseases, seldom shows itself with such general symptoms as demand or would justify, in the opinion of the practitioners treating them, or indeed could bear, the large bleedings which were formerly regarded as the appropriate remedy, and which accordingly are now seldom practised." There are not only also fewer examples of violent inflammation of the lungs to be met with, but the *usual* (highly inflammatory) type of fever attending such inflammation has materially changed, as occurring in the present day. This change which has taken place in the *type* of the usual phenomena characteristic of inflammatory fever, cannot be explained merely by the circumstance that a previously enfeebled or diseased state of the system has brought it about in the individual. The inflammations of internal parts, such as pneumonia, now *occur often without febrile re-action*, and neither demanding nor bearing full bleedings, as described by Cullen and other authors. It is consistent, moreover, with the extensive experience of Drs. Alison, Christison, Watson, and many other physicians of the greatest eminence and long experience, that the inflammations now seldom occur with such severe symptoms of inflammatory fever as have been described at page 98, and which were the rule in the time of Cullen and of Gregory. The constitutional symptoms now attending such inflammations partake more of the type of the so-called *typhoid* state, and independent of any epidemic influence or poison having acted on the body.

The constitutional symptoms for many years past accompanying pneumonia, for instance, in this country, have been of the following kind:—An enfeebled circulation; softness of the pulse, and easiness of depression by depletion, or even by taking the erect posture; tremors and feebleness of voluntary muscular motion, approaching to subsultus; indifference to surrounding objects, approaching to typhoid delirium stupor; sickness and vomiting in some cases, with dryness and feebleness of tongue and lips in others; complete anorexia or depraved appetite; in all, the symptoms generally tend to assume those of the so-called *typhoid* state, rather than of *inflammatory fever*. Nevertheless, in the treatment of such cases, blood taken *sufficiently early* is distinctly beneficial; and although it may show the *buffy coat*, this has neither the thickness nor the tenacity of the *fine buffy coat* seen and described in former days; faintness also supervenes on the loss of a quantity, small in comparison of what was formerly well borne, and there

is no such encouragment to a repetition of the bleeding, from the pulse speedily regaining its strength, or from the local symptoms abating and quickly recurring, as was formerly noticed by Cullen, Gregory, Christison, Alison, and other veterans in the practice of medicine. Dr. Gairdner also points out the great distinction to be drawn between the doctrines of Alison and of Todd in this respect. Dr. Alison recognized the disuse of blood-letting, and the increased necessity for stimulants as a *consequence* of the changes he observed in the character of diseases. Dr. Todd, on the other hand, disowned entirely the idea of such a change, and came to regard the administration of stimulants as a matter of routine. The former recognized the altered type of disease, the changes observed in its physiological manifestations, and the gradual disappearance of those forms of acute inflammation which before had appeared to require and to bear blood-letting. Dr. Todd did not recognize nor acknowledge these changes. (*Clinical Medicine*, 1862, p. 34.) The mode of fatal termination is also different. The tendency to death is now most usually either by *coma* or by *asthenia*, as in typhus fever. The tendency to gangrene has also become much more frequent in various inflammations of internal parts, and particularly in the lungs, within the last forty years, than it was in the time of Cullen and of Gregory. Such is the matured records of experience, as stated by the late Dr. Alison in a series of papers published in *The Edinburgh Medical Journal* in 1855, 1856, and 1857; than whom the opinion of no one is more entitled to respect and consideration. "Although dead, he yet speaketh."

Dr. Handfield Jones, physician to St. Mary's Hospital, London, observes, "that instances of impaired action of the heart, sometimes amounting to serious danger, are met with at the present time, with an absence of all conditions which require or justify venesection. This is associated with other symptoms of depressed nervous power, which appear to be most reasonably attributed to some kind of epidemic influence much resembling that of malarious diseases.

The type of disease which reigns at present, and which seems to have prevailed more or less since the appearance of pestilential cholera amongst us, is also decidedly unsuited to the beneficial action of mercury. There is now little of sthenic inflammation; bleeding and tartar emetic are but sparingly needed, while qui-

nine, strychnine, and other tonics, with opium, and cod-liver oil, are continually in requisition in our efforts to raise and maintain failing power. (*Medical Journal*, March, 1857.) According to the experience of obstetric practice, the observations of Mr. Sidey, of Edinburgh, are to the same effect. He records that the epidemic of influenza in this country thirty years ago was of a most inflammatory character. We now know that cases of influenza generally assume the *asthenic* type, and demand a different treatment. Moreover, he observes that it is consistent with the experience of the veterinarians that the change in the type of disease has been observed among the lower animals to the same extent as in man.

In 1782, when Dr. Hamilton published his memoirs on the "*contagious catarrh*," or *influenza*, he records distinctly his belief that "our constitutions are considerably changed within the last century in Great Britain. Diseases," he remarks, "in their nature phlogistic (*e. g.*, *measles*), have appeared within the thirty years previous to 1782 less inflammatory than they formerly were, and accompanied with a considerable degree of putridity;" and blood-letting, in the "*contagious catarrh*," he states with emphasis, cannot be tolerated. There seems, therefore, to have been even then an increasing belief that the degeneracy of the human race, as a whole, is in some respects advancing; and there seems some visible evidence of this more or less traceable through the past four generations.

Morel especially directs attention to the apparent increase in Europe of mental alienation, and of those abnormal states of existence which have special relations with the occurrence and existence of physical and moral evil in the world; and if a comparative increase in the number of the insane cannot yet be proven, there would seem to be a tendency to more frequent complications among them of those morbid states which diminish the probability of cure, such as *general paralysis*, *epilepsy*, and a marked depression of all the intellectual and physical forces, which depression characterizes the *asthenic* phase of present existence. *Hysteria* and *hypochondriasis*, formerly almost the exclusive appanage of the rich, the indolent, and those of a wasted life, are known to attack in great proportions the working and the agricultural classes, among whom also suicidal tendencies not unfrequently prevail.

Dr. Forbes Winslow writes, with regard to nervous diseases, that cases of disease of the brain and nervous system are now also not only of more frequent occurrence, but that a certain unfavourable type of cerebral disorder develops itself in the present age at a much earlier period than formerly. Softening of the brain, for instance, now often manifests itself at the early age of thirty and thirty-five. The brain in the present day is overworked, its psychical functions are unduly exercised, strained, and taxed in the great effort required in the severe struggle and battle of life to obtain intellectual supremacy, professional emolument, and status. (*Journal of Psychological Medicine*, July, 1857.)

Morel again shows how imbecility, congenital or early acquired idiocy, and other more or less complete arrests of development of the body, and of the intellectual faculties, indicate the existence of children who have acquired the elements of their degeneracy during intra-uterine life. It behoves, then, all civilized governments anxiously to inquire into and to consider such facts as show,—(1.) The continued increase of suicide; (2.) The continued increase of crimes against order and law, or against the person; (3.) The monstrous precocity of young criminals; (4.) The abnormal conformations of the skull, and tendency to early union of the cranial sutures, which prevail among criminals. So much is this the case, that in large towns, or in penal settlements and convict prisons, the physiognomy and general aspect of the “criminal population” is characteristic of a class; (5.) The general diminution of the intellectual powers, with the manifestation of the most depraved immoral tendencies; (6.) The increase in the inmates of asylums and prisons; (7.) The etiolation, blanching, anæmic or cachectic condition of the population, and any relative increase of such constitutional diseases as *anæmia*, *chlorosis*, *gout*, *Bright's disease*, *rheumatism*, *melituria*; (8.) The increased development of paralytic and convulsive affections. These are the main directions in which the degeneracy of the human race is demonstrable; so much so that in some localities the inhabitants can no longer fulfil the conditions required for military service. (*Traité des Dégénérescences Physiques, Intellectuelles et Morales de l'Espèce Humaine, et des Causes qui produisent ces Variétés Maladies*. Par le Dr. B. A. Morel, de l'Asile des Aliénés de S'Yon, 1857.)

The principal sources of degeneracy which appear at present

to be most active in their influence for evil on large masses of mankind may be stated as follows:—(1.) Degeneracy from *Toxæmia*, as from the abuse of alcoholic fluids, opium, preparations of Indian hemp (hachisch), tobacco, and the like; also from the effects of mineral poisons, such as lead, mercury, arsenic, phosphorus; and from the use of unwholesome vegetable food, such as diseased rye, maize, wheat, and the like. (2.) Degeneracy from the persistent and pernicious influence of *malaria*. (3.) Degeneracy from certain peculiar geological formations, soil water, &c., as in the development of goitre (MACLELLAN, WATSON). See Paper on Hygiene of India, in *Med.-Ch. Rev.* (4.) Degeneracy from the effects of epidemic diseases which now and then afflict large populations, profoundly influencing the system, and engendering those morbid temperaments whose types are more fully expressed in the generations which follow the one that has suffered from such epidemic pestilences. Many of such-like epidemics act like toxic agents on the nervous system. (5.) Degeneracy from the effects of the “*great town system*,” as the phrase is. The chief elements of such degeneracy are, (a) unhealthy situations, (b) a noxious local and general atmosphere, (c) insufficient air, (d) insufficient and improper nourishment, (e) deleterious avocations, (f) moral and social misery, wretchedness, and crime. (6.) Degeneracy from fundamental morbid states, congenital or acquired, as seen in the imperfect cerebral developments, deaf mutism, blindness, constitutional diseases and diathesis, implanted, hereditary, or acquired, such as syphilis, and scrofulosis. (7.) Degeneracy from mixed causes, from marrying in and in; and from other causes not included in the above. (*Med.-Ch. Rev.*, Jan., 1858.)

By far the most active sources of degeneracy are thus seen to be those direct and repeated influences upon the blood, the brain, and the nervous system, which give rise to special morbid conditions; and which often place those who periodically expose themselves to the influence of toxic agents in a condition verging on or equivalent to insanity. The effects of *chronic alcoholism*, for instance, in giving rise surely and progressively to the *degeneration* of the individual, are mainly demonstrable by the induction of the following states, namely:—persistent loss of appetite, indigestion, nausea; occasional diarrhœa, progressive emaciation, and cachexia; the appearance of pustular eruptions; the occur-

rence of eructations associated with offensive breath; serious disturbance of the functions of the stomach, liver, kidneys, and heart, and the production of organic lesions in these organs, and in the structures of the blood-vessels, followed by fatal *serous effusions, dropsy, hæmorrhages, extravasations, or apoplexies*. Intercurrent with these morbid conditions, at variable periods and otherwise contingently, "fits of drunkenness," with sexual incompetency, different forms of psychical aberration, *delirium tremens*; suicidal melancholy, and such-like morbid phenomena ensue. Finally, epileptiform seizures, general paralysis, drivelling or slavinger idiocy, may close the scene. Those who become thus degenerate by alcoholic poison are arranged by Morel into two classes, namely,—*First*, Individuals who arrive at length, by a series of well-marked nervous lesions—physical and intellectual—at general paralysis. *Second*, Individuals who, although profoundly affected as regards innervation, still remain stationary at a certain state, leading a miserable existence, characterized *physically* by a special condition of ill-health (cachexia and marasmus), and *morally* by a manifestation of the worst tendencies, and of the lowest animal propensities. The serious degenerative effects thus detailed in their extreme forms, resulting from the poison of alcohol, ultimately influences the procreative functions; first, by diminishing the vital standard of the offspring; and second, by annihilating the generative power altogether. When such results are coupled with the moral and social aberrations which ensue from bad example, misery, and want, in families and masses of men, they become ample sources of the degeneracy and degradation of the population, not only throughout the existing but succeeding generation; and not only is the vice of alcoholic abuse hereditarily transmissible (MOREL), but it also frequently leads to insanity in the offspring of the drunkard (WHITEHEAD, ADAMS); and in cases where the tendency to alcoholic excesses has a hereditary origin, the cure of the dipsomaniac is generally impossible. Morel gives the following example, in which a well-marked succession of morbid phenomena became developed in different descendants of a family throughout four generations. The great-grandfather of the family was a dipsomaniac; and so complete was the transmission of the disease, that the race became totally extinct, under the well-marked phenomena of alcoholic poisoning and degeneracy. The effects entailed were: in the first genera-

tion, alcoholic excesses, immorality, depravity, brutish disposition; in the second generation, hereditary drunkenness, attacks of mania, general paralysis; in the third generation, sobriety prevailed, but hypochondriasis, lypomania, persistent ideas of persecution, homicidal tendencies, were expressed; in the fourth generation, intelligence was but feeble, mania became developed at sixteen years of age, stupidity running on to idiocy, and to a condition involving extinction of the race.

Sir James Clark also made the observation, more than twenty years ago, that the constitutions of the past three generations had deteriorated progressively from father to son. (*Treatise on Pulmonary Consumption*, p. 11.)

The persistent pernicious influence of the marsh poison will be fully noticed in the last part of this treatise; but there are other abundant sources of constitutionally morbid influences; and, whatever the explanation may be, it certainly is a matter of fact, as the late Dr. Alison wrote, that the *constitutional affections*, going along with the same extent of inflammation and its local effects, are extremely various in different persons previously alike in good health, or even in the same person at different times; and that we are not entitled to deny that what happens in this way in different individual cases may not happen also in nations and in seasons. As we are still very imperfectly informed as to the mode in which any local inflammation excites constitutional fever, we have no reason to doubt that the constitutional re-action consequent on the excitement of a certain degree of inflammation of the lungs may vary, equally as that which is consequent on the introduction of a certain quantity of the poison exciting *typhus fever*, *measles*, *scarlatina*, or *cholera*; in all of which the previous muscular strength goes for nothing in determining the degree or danger of depression or debility which may ensue.

Dr. Christison has also recently (1857) communicated to the Medico-Chirurgical Society of Edinburgh his experience relative to the changes which have taken place in the constitution of fevers and inflammations in Edinburgh during the last forty years. His experience, as well as that of many of the older physicians of Edinburgh, shows that a transition had and did every now and then take place from an *inflammatory form* of fever to one of an *asthenic type*; that it was necessary also, on the outburst of any

epidemic, to watch carefully the early cases, to observe the mode in which the fatal cases terminate, and to observe generally the *constitutional tendency* or type of individual cases, in order to form an accurate judgment of the general character of the epidemic about to prevail. It will be seen also, on referring to the most approved and recent works on the diseases of India, that the descriptions of inflammations as well as fevers now seen there, when compared with the statements of Dr. Johnson, Mr. Twining, and others, twenty-five or thirty years ago, may be held to indicate that there has been a change in the usual form of *re-action* in inflammatory diseases in that climate as well as here. Such conclusions may be inferred from the experience of Dr. Morehead, recorded in his *Clinical Researches on the Diseases of India* (vol. ii, pp. 71, 72, and 359); and the experience of Sir Ranald Martin, expressed in his recent classic work on Climate, bears out the same observation.

It appears evident, therefore, that the *human body* is capable, from causes known as well as unknown to us, of undergoing various alterations as regards not only its *physical*, but also what has been termed its "*Medical Constitution*." *Fevers* are known to change their types; *epidemics* to assume new tendencies; and *inflammations* and *local lesions* to affect in no constant manner the constitution of individuals at the same period, or at different times and in different countries. This view of the subject may be summed up in the eloquent language of Dr. Watson, when he writes,—“I am firmly persuaded, by my own observation, and by the records of medicine, that there are waves of time through which the *sthenic* and the *asthenic* characters of disease prevail in succession, and that we are at present living in one of its adynamic phases.” (*Edin. Monthly Journal*, June, 1857.)

But another view of this most important subject has been ably advocated by Dr. J. H. Bennett, of Edinburgh. He contends that inflammation is the same now as it has ever been—that the analogy sought to be established between it and the varying types of fevers is fallacious—that we cannot place reliance on the recorded experience of the past—and that our recent changes in therapeutics are solely due to an advanced knowledge of diagnosis and pathology. (*Principles and Practice of Medicine*, p. 267.)

The local phenomena of inflammation are undoubtedly con-

stant; but the question of change of type has only reference to the constitution of the individual and the constitutional expression of the inflammatory state. Much of the argument, therefore, is beside the question, which may now be well left as Dr. Watson has happily expressed it, and which has just been quoted.

CHAPTER IX.

MODES BY WHICH DISEASES TERMINATE FATALLY.

OUR knowledge on this subject is derived chiefly from three sources, namely, from the examples and illustrations afforded by the study of,—(1.) Death from old age; (2.) Death from fatal injuries; (3.) The powers and actions of all our best remedies. Such study leads to the important practical conclusion, that the same lesions of important organs may prove fatal in very different ways, and the fatal event may be averted by very different and very opposite remedies (ALISON). It is also to be observed, that in constitutions which are unimpaired, and, indeed, in every morbid process, there may be recognized a tendency to a spontaneous favourable termination.

Death happens either from the decay of life, as in old age; or it happens as an accident caused by some of those untoward lesions or derangements of the vital organs which occur in the course of the various diseases and injuries to which mankind are liable.

Death by *extreme old age* may be considered in many instances as the desirable end of a long-continued and perhaps a dreary journey. The sufferer appears to fall asleep as he might do after severe fatigue. The long and weary journey of life is thus often brought to a close, with little apparent derangement of the ordinary mental powers; the final scene is often brief, and the phenomena of dying are almost imperceptible. The senses fail, as if sleep were about to supervene; the perceptions become gradually more and more obtuse, and by degrees the aged man seems to pass into his final slumber. We scarce can tell the precise instant at which the solemn change from life to death has been com-

pleted. Sensation fails first, then voluntary motion; but the powers of involuntary muscular contraction, under the excitement of some external stimulus, may continue for some time longer to be feebly expressed. The blood generally ceases at first to be propelled to the extremities. The pulsations of the heart become less and less efficient. The blood fails to complete its circuit, so that the feet and hands become cold as the blood leaves them, and the decline of temperature gradually advances to the central parts. Thus far the act of dying seems to be as painless as that of falling asleep; and those who have recovered after apparent death from drowning, and after sensation has been totally lost, assert that they have experienced no pain. What is called significantly the *agony of death* may therefore be presumed to be purely automatic, and therefore unfelt. The mind, doubtless, at that solemn moment may be absorbed with that instantaneous review of impressions made upon the brain in bygone times, and which are said to present themselves with such overwhelming power, vividness, and force, that, in the words of Montaigne, "we appear to lose, with little anxiety, the consciousness of light and of ourselves." At such a time the vivid impressions of a life well-spent must constitute that *euthanasia*—that happy death—to be desired by all.

The untoward lesions or derangements of vital organs, which occur during the progress of disease, terminate the life of man by various modes of dying. While it is ordained that eventually all must die, yet it is possible sometimes to avert, for a time, the tendency to death. To know by what agents this may be properly accomplished, it is necessary to know the modes in which death may approach in disease. Dr. Watson has happily observed that life rests upon a tripod, whose three vital supports are, the *heart*, the *brain*, and the *lungs*. Through the impaired functions of some one or more of these organs the tendency to death is expressed. The mode of dying may begin at the *head*, the *heart*, or the *lungs* (BICHAT). But inasmuch as the functions of these organs are mutually dependent upon each other, so impairment of function in any one of them may ultimately lead to death, while the mode of dying is expressed chiefly through the functions of another. The mode of dying in disease is usually a complex one, for many parts thus mutually dependent on each other are more or less immediately involved. Therefore it is of the greatest practical importance to observe how and

when the different functions begin to languish, and how they may be best sustained in their exertions to maintain life.

When a person loses blood to such an extent that he faints, as from a wound, or by hæmorrhage occurring in disease, and if the flow of blood is not arrested, the state of *faint* or *syncope* continues, is not recovered from, and the heart's action ceases; not because it is unable to contract, but because its natural stimulus, the blood, is withdrawn from it, or does not arrive in sufficient quantity to be of use. This is called death by *anæmia*. In such cases, if blood can be timeously supplied to the heart (as by the operation of transfusion from a healthy person into the patient who is losing blood), the suspended function of the heart may be restored, and a supply of blood, sufficient to maintain life for a time, may be thus obtained.

The symptoms of approaching death by this mode of dying are, paleness of the countenance and lips, cold sweats, dimness of vision, dilated pupils, vertigo, a slow, weak, irregular pulse, and speedy insensibility. If the hæmorrhage has been sudden, in large quantity, as from the uterus in "flooding," there may be nausea, or even vomiting, restlessness, tossing of the limbs, irregular sighing breathing (*anxietas*), delirium, and one or two convulsions before death ensues.

But another mode of death may be more immediately connected with the heart itself, and be independent of the supply of blood. In other words, the stimulus from blood may be sufficient, but the contractile power of the organ may fail. Such a mode of death is by *asthenia*. Many poisons act in this way, and many diseases which are due to morbid poisons in the blood tend to prove fatal by this mode of dying. Cases of extensive mortification of parts, of acute inflammation of the peritoneum, and of malignant cholera, die in this way.

The symptoms consist in the pulse becoming feeble and frequent, and ultimately failing altogether to be perceived. The muscular debility becomes extreme, but the senses remain perfect, often painfully acute, and the intellect clear to the last.

Persons whose death is by *anæmia* or by *asthenia* are often spoken of as having died in a faint, or by *syncope*; and there is still a mode of dying intermediate between the two, the type of which is seen in *death by starvation*.

Death may also be produced by the suspension of the functions

of respiration, as when access of air to the lungs is prevented by a direct obstruction, either to the air passage, in choking, or to the action of the chest, so as to prevent its expansion; or when the actions of the muscles of respiration cease, in consequence of disease or injury to the brain producing insensibility. The first of these modes by which the respiratory functions are suspended is that known as *suffocation*, technically expressed by the term *apnœa*, or privation of breath. Examples of this mode of dying may be referred to in cases of *drowning*, *smothering*, *choking*, *strangulation*, *throttling*, and closure of the *rima glottidis* by foreign bodies. In Dr. Allen Thomson's anatomical museum at Glasgow there is a larynx preserved in which a piece of coal is wedged between the *rima glottidis*. A collier thus died by *apnœa* or *suffocation* produced by the piece of coal dropping into the larynx while he lay on his back in the mine, excavating the coal from the roof of the coal pit. Forcible pressure upon the chest, as sometimes happens in crowds during a continued crush of people, or occurs to workmen who have been buried by falls of earth and rubbish; in short, whatever causes an immovable condition of the lung case beyond a period of three minutes and a half will thus produce a fatal result. Tetanus, and the influence of strychnine, prove fatal in this way. Morbid states, produced by disease, and which terminate fatally by *apnœa*, are *œdema* of the glottis; disease of the spinal cord above the origin of the respiratory nerves (phrenic, intercostals and spinal accessory); effusion of serum into the pleural cavities; sudden infiltration of the lungs by inflammatory exudation, or collapse of the lung in bronchitis.

The symptoms of approaching dissolution by this mode of dying are, strong but ineffectual efforts to contract the respiratory muscles and struggling efforts to respire, amounting to agony, of short duration, followed by vertigo, loss of consciousness, and convulsions; at last all effort ceases, twitchings or tremors of the limbs alone remain, the muscles relax, and the sphincters yield. The heart and the pulse, however, still continue to act after all other signs of life are past. The recent experiments instituted by the Medico-Chirurgical Society of London show that, on an average, the heart's action continues for three minutes fifteen seconds after the animal has ceased to make respiratory efforts. On this last circumstance rests our hope of resuscitating persons so suffocated,

if artificial respiration be timeously resorted to, and persevered in. This prolonged action of the heart circulates blood, which is dark, venous, and not arterialized, and accordingly the face, at first flushed, becomes turgid, and then assumes a livid and purple hue; the veins of the head and neck swell, the eyeballs protrude from their sockets. At length the heart ceases to beat, and life is extinct (WATSON).

Death by coma occurs when there is a loss of consciousness first, with the appearance of profound sleep, from which the patient may be partially roused. The symptoms of approaching death by this mode of dying consists in a gradual blunting of sensibility to outward impressions, slowness of respiration, the inspiratory effort being often delayed, and then performed with a sudden noise and jerking inspiratory effort, technically known as *stertorous* breathing. All voluntary attention to the act of breathing is lost, but the influence of a reflex stimulus to its performance continues. At length this function fails also. The chest ceases to expand, the blood is no longer aërated, and thenceforward precisely the same changes occur as in death by apnoea.

Such are the several modes by which death tends to approach; and "*to obviate the tendency to death*" is a doctrine which was often and strenuously inculcated by Cullen. After him, no less earnestly has it been impressed on many by my respected teacher, the late Professor Alison, whose interesting Lectures on *fevers* and *inflammation* furnished numerous illustrations. To his *Outlines of Pathology and Practice of Medicine*, and to the first volume of Dr. Watson's *Lectures on the Principles and Practice of Physic*, the student is referred who would seek further information—sources whence the preceding observations have been mainly compiled relative to the modes by which death may approach,—

" Many are the ways that lead
To his grim cave, all dismal; yet to sense
More terrible at the entrance than within."

CHAPTER X.

PRINCIPLES WHICH DICTATE THE TREATMENT OF THE COMPLEX MORBID PROCESSES.

I. *As regards Fevers or the Febrile State.*

To avert the tendency to death in the febrile state, it is necessary to observe how fevers naturally terminate favourably. Four modes are enumerated by Dr. Parkes, namely:—

1. *By crisis*, in which the temperature falls suddenly in a few hours, and usually with some abundant excretory discharge, in which, possibly, much of the water which has been retained in the system is poured out.

2. *By lysis*, in which the fall of temperature is gradual from day to day, till the normal standard is attained. The decline may thus occupy many days, the thermometer being known to take seven days in falling from 102° to 98° Fahr.

3. *By a combination of these two modes*, namely, by a sudden fall of temperature to a certain point, and then a gradual decrease to the normal heat.

4. Another mode has been observed by Dr. Parkes, namely—*By a somewhat irregular alternation of febrile and non-febrile periods as shown by the temperature and the issue.*

When *fever* terminates by any of these modes, convalescence commences, normal nutrition is renewed, and the body begins to gain in weight. The blood is poor in albumen and in red particles; and there is now a danger that the rapidity of metamorphoses of tissue will exceed the healthy standard, as shown by the great tendency which convalescents from fever have to lose heat. The temperature may fall, and the excretions may diminish below their healthy amount. Great care, constant attendance, and watchfulness, are required when the patient begins to convalesce, if the fever has been long and severe; and the treatment of the febrile state itself may be thus generally stated as consisting in a combination of measures,—(1.) To reduce excessive heat; (2.) To insure proper excretion and elimination of the excretions; (3.) To act on the exhausted and semi-paralyzed nerves; (4.) To neutralize any specific poison which may have

set up the fever, and so to improve the state of the blood; (5.) To relieve distressing symptoms; and lastly, To obviate and counteract local complications (PARKES, MURCHISON).

To accomplish the first indication, Dr. Currie practised to an extreme degree the application of cold water. In health such an application tends to increase the metamorphoses of tissue, as shown by Lehmann and Sanderson; and therefore its excessive use is contra-indicated in the febrile state. Blood-letting or hæmorrhage also tends to reduce temperature; but blood-letting can rarely be tolerated in many specific fevers, such as typhus, typhoid, scarlatina, and the like. *Infusion of digitalis* has been found by Wunderlich to have a wonderful influence in reducing and moderating the temperature in many febrile states, such as typhoid fever. Purgatives and emetics have the same effect, but in a less degree, and the temperature soon rises after the diarrhœa ceases when it has been induced by drugs.

To insure proper excretion, and to promote its elimination in fever, is much more difficult than to reduce temperature; which, for obvious reasons, it is not always judicious to attempt.

The system ought to be supplied with an abundance of alkaline salts, if the urinary excretions are not eliminated. *Chloride of sodium*, the *alkaline salts of soda and of potash*, tend to aid the formation of urea and its elimination. Purgatives generally also tend to insure a proper excretion, probably by removing from the blood some of the abnormal products formed in fever, and great relief sometimes follows their moderate use. Where urea is retained they promote its elimination, because it is known that urea sometimes passes off by the mucous membrane of the intestines.

The most important indication, however, in the management of the febrile state, is to find some substance which will act upon the nervous system, and which will restore the exhausted energies of the nervous centres. Food, mild stimulants, and quinine are all more or less employed. Quinine especially may be employed with benefit. Lately, infusion of coffee as a medicine has been given by Dr. Parkes, with the beneficial effect of relieving headache. Böcker and Lehmann have shown that the use of coffee, in health, delays the metamorphoses of tissue, and excites the nervous system. The special treatment of the febrile state depends on the diseases of which it forms a part, and by which it is more or

less modified. It will form a topic of consideration in the part which treats of special diseases. But it is above all necessary to guard against the habit of trying always to be doing *something*. As a routine system, nothing can be laid down as a rule, either in the direction of depletion, or of evacuants, or of stimulation. The febrile state is in many diseases part of the essence of the morbid state, which cannot be cut short nor materially subdued by remedies.

II. *As regards Inflammation.*

It is necessary clearly to understand and to bear in mind that, in the first instance, it is not the *lesion* which may attend the inflammatory process as a result, which is to be attended to; but it is *the diseased action tending to the lesion* which it is the object of the physician to overcome, to subdue, and turn aside; and that the occurrence of any lesion is, if possible, to be prevented. It is to the *strictly vital action—the excitement of tissue*—which tends to the organic lesion, that remedies must be applied, in order to avert the tendency to lesion, expressed by the symptoms of a constitutional kind, already referred to.

The treatment which will subdue this tendency has been technically called “*antiphlogistic treatment*.” Its mode of action depends upon the regulation and adoption of every agent, plan, or circumstance most favourable to the subsidence of the inflammation, and which will favour the influence of remedies, and oppose the advance and persistence of the inflammatory tendency. The treatment embraces,—(1.) Antiphlogistic regimen; (2.) Antiphlogistic remedies.

The *regimen* consists in,—(1.) A sparing allowance of non-nutritious diet; the administration of bland, simple, and cooling drinks, given often and in small quantities; (2.) Absolute rest of body and mind; (3.) Residence in a well-ventilated apartment, maintained at a temperature of about 62°.

The *remedies* comprehend *blood-letting, purgatives, emetics, mercury, opium, antimony, diuretics, and saline drugs*.

The most important and the most efficient of these remedies is undoubtedly *blood-letting*; while it must at the same time be remembered that it is not every case of inflammation that requires or warrants the abstraction of blood in the present existing *medical constitution*. It is a spoliative remedy, powerful for good

and for evil. In the treatment of inflammation, it has been well observed by Dr. Watson, that "each case requires its special study, speaks its proper language, furnishes its peculiar indications, and reads its own lessons." The carefully recorded facts of well-conducted though empirical observation, for hundreds of years, have attested the immediate sanative influence of blood-letting in *incipient* inflammation; and the most eminent physicians of by-gone modern times have recorded, in unmistakable language, how potent is this remedy for good, and the reasons for their belief.

Our forefathers well knew when the body suffered from an inflammation in the "*inward parts*;" and in saying this, we give them credit for far less scientific knowledge than they really possessed. Against such inflammations, whether in the *head*, the *chest*, or the *abdomen*, they learned by "*watching* and not by *counting*" the sanative efficacy of early venesection; and they obtained most trustworthy evidence and experience of its power to control inflammation. Following up such doctrines, will be found those veteran physicians who hold the foremost rank in the science of medicine of the present day in this country. The doctrine generally taught and universally acted upon with reference to blood-letting in inflammations is, "*so to bleed as to secure the advantages of the remedy, and to avoid its disadvantages*" (WATSON).

The standard examples of what blood-letting can do soon become apparent to every surgeon's apprentice, or hospital pupil, if he does not himself swoon the first time he sees the blood flow from the patient whom his master and teacher may wish to relieve. He may see the apoplectic sufferer roused to consciousness while the blood yet flows from the vein; and he may observe also, that the *stounding pains* of the head in cephalic inflammations are immediately relieved, that the impatience of light and sound, the frequent sharp intermittent pulse, with vomiting or nausea on assuming the erect posture, the tendency to squint,—in short, all the urgent symptoms of incipient encephalitis, at once, or one by one, disappear as the blood continues to flow. He may frequently also notice in *thoracic* inflammation, that the pain, the dyspnoea, the tightness of the chest, all disappear. Dr. Alison, as regards pleurisy, and Dr. Watson, as regards inflammation of the bowels, bear personal testimony to the good

effects of blood-letting. They experienced its sanative influence in their own persons, and the practice undoubtedly saved their valuable lives from these respective diseases. Testimony from such personal experience has also been borne by the late Dr. Gregory, of Edinburgh, and before him by the celebrated Dr. Radcliffe; and so also is the testimony of many who, having experienced the benefit of the remedy once, imagine that, when again attacked with inflammation, they may be again relieved by its use. Of any one of these illustrious examples from personal experience it might be said, as Dr. Gregory said of Dr. Radcliffe, that "he was at least no fool; and we may depend upon it he would not have allowed a hundred ounces of blood to be taken from him in one day without good reason for it." (*Edin. Med. Jour.*, March, 1857.)

"Although much has been done," writes Dr. Alison, "particularly by the French pathologists, to enable us to judge of the texture within the chest which is the subject of inflammation, and although this is a matter of real importance, because we know that the history of the changes to be expected from inflammation in the bronchiæ, substance of the lungs and pleura, is materially different, and of course the diagnosis of these gives us a great advantage in studying the progress of any individual case,—yet as to the specific questions of blood-letting or not, the quantity, or the repetition of the blood-letting, our predecessors were very nearly as well informed as we are. It is an important practical error," he also continues, "to fix the attention, particularly of students of the profession, too much on those characters of disease which are drawn from changes of structure already effected, and to trust too exclusively to these as the diagnostics of different diseases; because, in many instances, these characters are not clearly perceptible until the latest and least remediable stage of diseases. The very object of the most important practice, moreover, in many cases, *is to prevent the occurrence of the changes on which these lesions depend.* After these lesions are once established, the cases are very often hopeless, or admit only of palliative treatment. In those diseases in which most can be done by art, our practice must always be guided in part by conjecture, because, if we wait for certainty, we very often wait until the time for successful practice is past; and therefore, although an accurate knowledge of the whole history of each disease is essential to its proper treatment, yet, in a practical view, the most important part of its history is *the assemblage and succession of symptoms*, by which its nature at least, if not its precise seat, may often be known, *before any decided lesion of structure has occurred.* Ac-

cordingly, when this department of pathology is too exclusively cultivated, the attention of students is often found to be fixed on the lesions to be expected after death, more than on the power and application of remedies, either to control the diseased actions, or relieve the symptoms, during life."

The immediate effects of loss of blood as a remedy in inflammation are,—(1.) A sedative result on the heart's action, by diminishing the quantity and altering the quality of the blood, the withdrawal of a considerable amount of stimulus from the central organ, and the depressing effect of sudden loss of blood, the excitability of the nervous system being thus reduced. (2.) The loss of blood generally has a derivative influence upon the blood in the part about to become the seat of effusion. This has been seen to occur in experiments upon the transparent parts of animals. (3.) Blood-letting facilitates the action of other remedies. (4.) While the effect of blood-letting is well known, by the observations of Louis and Alison, not always to check the extension of the sphere of inflammation, *yet it essentially modifies* its character (a) sometimes by limitation of its sphere to a certain extent, (b) by diminishing the quantity of blood from which the inflamed part is nourished, (c) rendering the fibrinous exudation more liable to re-absorption.

Of late the medical profession has proclaimed with no uncertain sound, especially from the metropolis of Scotland, as to the good effects of blood-letting in the treatment of inflammation. It is well known that no remedy demands a more careful study of its application or a more delicate adjustment of its powers; and therefore some general rules may be here stated as a guide in the use of the lancet.

1. The utility of blood-letting varies with the variations in the type of disease. A change in the type of inflammatory diseases (*i. e.*, in their usual symptoms, local and general, in their tendencies to certain local and general results rather than others, or a change in their mode of tending to a fatal termination) demands a new study and fresh adjustment of the remedy in each particular case, country, locality and epidemic.

2. There is no truth, perhaps, in medicine more conclusively determined than that we ought not to bleed, or if we do so, we must bleed sparingly, when the inflammation depends on or is associated with the action of a morbid poison. In epidemics,

therefore, of every kind, we should not hastily have recourse to the lancet, but should remember that the disease probably depends on a poison, has a course to run, and is not amenable to the mere abstraction of blood.

3. It is necessary to observe carefully and to watch the *combination* and *succession* of the *constitutional* and *local* symptoms from the commencement of the febrile attack, and so to judge as to the propriety of blood-letting.

4. In order to obtain the good effects of the remedy by a full bleeding, it must be done *prior* to fibrinous *effusion* or *new growth*; seeing that it is *the diseased action which tends towards the lesion*—namely, effusion or growth of new material—which the physician desires to control by this remedy.

5. When the symptoms of *inflammatory fever* are little complicated and seen early, in persons previously healthy, the more violent the symptoms are, the more intense and rapid the constitutional re-action, if it does not indicate exhaustion, and the more decided the change on the function of the part affected, the more confidently we may depend on the effect of full blood-letting in relieving them.

6. When the symptoms of inflammatory fever have been uncertain and insidious in the beginning, so that the early stage has passed over unchecked, or modified by previously existing constitutional disease, or complicated with organic local disease, or when they denote debility, exhaustion, or the so-called typhoid state, they generally prove improper cases for blood-letting even when seen within the first few days.

7. Generally, it may be stated, that when the fever is inflammatory, when we may be sure that over a part of the inflamed organ there is congestion, stagnation of blood, distension of vessels, commencing extravasation, and change of the constitution of the blood—but these latter changes still partial and not far advanced—the power of blood-letting to control the disease has been clearly established.

8. The nature of the membrane or organ affected must always be considered in estimating the propriety of bleeding. If a serous membrane, for instance, be actually inflamed, the patient, for the most part, bears bleeding well, and is usually greatly relieved by it. Erysipelas spreading, tending to vesicate, and accompanied with acute inflammatory fever, also bears bleeding well. If, on

the contrary, asthenic symptoms are present, and an epidemic prevails, the advantages of the remedy may be doubted. With respect to organs, it is found that inflammation of the brain is less influenced by bleeding than inflammation of the liver, and inflammation of the liver than inflammation of the lungs. The symptoms which demand a full blood-letting in pneumonia, are also those which indicate the greatest danger—namely, violent pyrexia, usually beginning suddenly, with full, strong, hard, and quick pulse—urgent *dyspnœa*, even *orthopnœa*—swelling and flushing of the face, frequency and violence of cough, with scanty or truly pneumonic expectoration, aggravating the pain which extends through the chest,—when such symptoms are seen within *three* days of their commencement, especially in those of robust and full habit in the prime of life, blood-letting is the remedy to be used, everything else is *trifling*, and it is *not safe* to dispense with it. The nearer a case answers this description, the more sure we may be that the effect of blood-letting will be satisfactory, and its repetition, if the symptoms shall recur, will be well borne (ALISON). But the type of inflammation of the lungs and other parts prevailing in our time is rarely of this nature; and it is often not less dangerous because the symptoms partake of an *asthenic* type; yet such inflammations get well without such large bleedings as used to be demanded, the loss of a very small quantity of blood making a sufficient impression on the progress of the diseased action, tending to the lesion, as checks it efficiently.

9. It is found in practice, also, that this most powerful of therapeutic agents, in the cure of inflammation, requires the greatest caution in its repetition, for there is a line beyond which bleeding becomes destructive, instead of remedial. Two indications are of great use in determining as to the propriety of a second blood-letting, namely,—

(a) *As to how the first bleeding is borne*—a test first suggested by the late Dr. Marshal Hall. If much blood flow before any tendency to syncope manifests itself, venesection is then considered to be well borne; if, on the contrary, the patient soon faints after a vein is opened, the judicious practitioner desists from further depletion. The urgent symptoms, being thus relieved for the moment, may again return, after a longer or shorter interval, and thus demand a repetition of the remedy, to

be now judged of (*b*) by the re-action of the system generally, as indicated by the state of the local symptoms, their urgency for relief, the character of the pulse, and the appearance of the blood first drawn. The re-action may be of such a kind that a *sthenic* state of *inflammatory fever* still continues, or returns after temporary subsidence. The inflammatory process having been interrupted, so far modified, but not arrested, the remission proves transient, and the re-accession may be more fierce than the onset. A repetition of blood-letting is demanded so soon as such re-action has declared itself. On the contrary, the re-action may be *asthenic*, or of nervous character, the pulse being rapid, soft, and jerking, the breathing oppressed, headache and *tinnitus aurium* present, with general nervous excitement; bleeding, under such circumstances, is *not to be repeated*. A full opiate will allay the nervous excitement.

10. The next consideration is, "What indications for bleeding are to be drawn from the state of the blood?" The blood offers certain therapeutic indications, either for bleeding or refraining from it, when the symptoms would otherwise demand or forbid this operation. The firmness of the coagulum, for example, has been considered at all times as a mark of the tonic state of the system, and as a warranty for repeating the bleeding when the part is as yet unrelieved, and the re-action continues of the *sthenic* type.

The thickness, and especially the firmness, of the *buffy* coat, if lifted on a pin, was one of the leading characteristics of the existence of acute inflammation, amongst others already noticed, and was much founded upon by Dr. Gregory, as guiding his practice in the treatment of inflammation. On the contrary, a looseness of texture of the clot is a sure sign of great debility, so that unless other circumstances strongly indicate the necessity of bleeding, it ought not to be repeated.

11. The proportion of the serum to the clot, and also its occasionally altered characters, are arguments also for or against bleeding. When the quantity of serum is unusually large, unless the clot be very firm, bleeding ought not to be repeated. Also, when the properties of the serum are so altered that it coagulates and forms one mass with the clot, bleeding is constantly prejudicial; and, lastly, it has been observed, that when the serum, which has little or no affinity for the red globules in health,

readily dissolves them, it is an unerring sign that further bleeding should be avoided. In some of the febrile diseases the fibrine never augments, remains often in normal quantity, and is also often diminished. In the acute inflammatory forms, on the contrary, there is a constant augmentation of this principle; as observed by Andral, the fibrine being in excess, compared with the red globules, and instead of being 3, as in health, oscillates between 4 and 10. It is this excess of fibrine which gives firmness to the clot, and is the cause of its being buffed and cupped. The immediate effect of bleeding, according to the same high authority, is to reduce the red globules, but not so with the fibrine; for a reduction of fibrine does not take place till after a certain time. Such is the state of the blood in the sthenic inflammatory states. There are many reasons, however, for not esteeming the buffed and cupped state of the blood, denoting an excess of fibrine, as a sufficient warranty for bleeding; for these conditions are often present in erysipelas, phthisis, or the early stages of typhus fever; and in either case the loss of a moderate quantity of blood might hurry the patient to his tomb. Again, in acute rheumatism the blood is not only buffed and cupped, but contains a maximum quantity of fibrine; yet the best practitioners seldom think it necessary to take blood, considering that mode of treatment as neither affording present relief nor shortening the course of the disease. The fact, then, of the blood being buffed and cupped does not in all cases warrant venesection. It is also well known that the sthenic or buffed characters of the blood are often greatly modified by the manner in which the blood is drawn; thus, if an individual be bled in both arms, and the blood allowed to flow with different velocities—that is, in a full stream from one and slowly from the other—the blood drawn is identically the same; yet a thick buff will be wanting in the latter and be present in the former. And if the apertures be of different sizes, the same differences will result; the blood from the larger orifice will be buffed, while no such effect is seen in the blood drawn from the smaller one. Again, the form of the vessel which receives the blood, as to whether it be flat or conical, and also its temperature, or whether the blood be received into one that is cold or warm, will also affect the phenomena of its coagulation.

There are many circumstances, therefore, which prevent the

blood from being an unerring guide for bleeding in cases of inflammation; but *the assemblage and succession of symptoms* must decide as to the propriety of blood-letting in doubtful cases.

12. An improvement in the character of the secretion or excretion from the inflamed part contra-indicates the repetition of blood-letting; for instance, in pneumonia, if the *character* of the expectoration, from being scanty, tenacious, and tinged with blood, becomes copious and free, much may be expected from this natural tendency to cure.

13. It is an object to effect the sanative result with as little expenditure of blood as possible; but the amount to be taken can only be judged of by the effects produced. The patient should be bled, if possible, in the upright position, and a full stream of blood allowed to flow from a sufficiently large orifice in a vein. To accomplish this fully, it may sometimes be necessary to open a vein in each arm, so that the flow may be from both at the same time.

Blood-letting may be employed either generally or locally. General bleeding is best adapted to subdue acute inflammation, because it makes a more decided and rapid impression upon the system. Local blood-letting, by leeching, scarification, or cupping, is more useful in chronic inflammation; but it is often advantageous to combine the two methods of taking blood.

The next most important class of depleting agents in the treatment of inflammation consists of *purgatives*. (1.) They free the stomach and intestines from accumulated food and fæces, or other irritating and acrid matters. (2.) They subdue the inflammatory tendency by the discharge of a large quantity of serous fluid charged with albumen, from a large extent of mucous membrane. Their use is especially indicated in *encephalic* inflammations and *hepatic* congestions; but they are less efficient in subduing *thoracic* inflammation; while in the *enteric* inflammations they ought not to be pushed beyond merely unloading the alimentary canal.

The influence of mercury varies with its mode of administration and the constitution of the patient. It is followed in large doses by an increased flow of watery evacuations from the bowels, and an increased flow of saliva.* If the use of the remedy is con-

* The experiments of Dr. George Scott, of Southampton, throw considerable doubts on the hitherto generally received opinion, that calomel in large and

tinued, especially in small and repeated doses, combined with opium, so that it is not passed off by the bowels, this mineral induces *salivation*—that is, saliva flows profusely, the gums become tender, red, swollen, and ulcerated on the margins in contact with the teeth. The patient gets rapidly thin during its use, and the red corpuscles of the blood are rapidly destroyed. Its sanative power is believed to consist in controlling or preventing the coagulation of lymph; and for this purpose it is used as an auxiliary to blood-letting. In the present prevailing type of inflammations, or in typhoid states, it is less useful than in the *sthenic* forms of inflammatory action. It is decidedly hurtful in cases of erysipelas disposed to gangrene, in scrofulous states of the system, in debility, and in cases where the nervous system is in an irritable condition, and the condition of the patient tending to the so-called typhoid state. The specific influence of mercury is recognized by the tenderness of the gums, which it induces, and by the peculiar mercurial factor of the breath. Calomel alone, or calomel combined with opium (a quarter of a grain of the latter, with two grains of the former; or a third of a grain of opium, with three or four grains of calomel), every three, four, or six hours, is the best form of administration where its influence is rapidly required.

The administration and sanative influence of other remedies used in the treatment of inflammations, such as *antimony*, *opium*, *colchicum*, *digitalis*, will be sufficiently illustrated in describing the nature and treatment of individual diseases; and it must be ever borne in mind that all treatment ought to be judiciously regulated by the knowledge of the tendency of the disease to a spontaneous favourable termination; the accidental symptoms of urgency requiring treatment and control in many cases, rather than the disease itself.

purgative doses increases the flow of bile; on the contrary, such doses seem, in the first instance, to diminish the flow of bile; and it is a matter for further experiment to determine whether small and frequent doses of calomel, continued for a length of time so as to produce the specific action of mercury upon the system, will really ultimately augment the biliary secretion. (Beale's *Archives*, vol. i., p. 209.)

THE
SCIENCE AND PRACTICE OF MEDICINE.

PART II.

METHODICAL NOSOLOGY—SYSTEMATIC MEDICINE, OR
THE DISTINCTIONS AND DEFINITIONS, THE NOMEN-
CLATURE AND CLASSIFICATION OF DISEASES.

CHAPTER I.

THE AIM AND OBJECTS OF NOSOLOGY.

NOSOLOGY regarded as a distinct department of the Science of Medicine, has been considered to embrace three separate objects of consideration:—namely, *First*, The DISTINCTION and DEFINITION of particular diseases, or of the genera and species of diseases; *Secondly*, The NOMENCLATURE of diseases, or the assignment of the names by which they are to be designated, so that each disease may be distinguished by an appropriate name; and, *Thirdly*, The ARRANGEMENT or CLASSIFICATION of diseases in some methodic and convenient order, by which they may be distributed into classes, orders, genera, or species. These three divisions of Nosology are respectively known as the DEFINITION, the NOMENCLATURE, and the CLASSIFICATION of diseases. Of these in their order.

I. **The Definitions of Diseases.**—The first object of Nosology is to obtain such brief enumerations of the peculiar characters of diseases as are sufficient to define them; and the practice of attempting to define diseases so as to lead to their being easily

recognized was begun before the time of Galen. In modern times the great advantages that have arisen from establishing definitions in natural history upon fixed and determinate principles, not only of its various objects individually, but also of the groups under which it was found possible to arrange them, suggested to medical men the idea that much advantage might also result to the Science of Medicine from defining diseases, and such groups of diseases as might be found expedient to recognize, under general terms or common names, based upon some fixed and determinate principles. Sydenham recommended that definitions or brief descriptions of diseases should be framed after the model of those that are given of plants; and he lays down various judicious rules for the proper execution of this object in the preface to his work *On Acute Diseases*, first published in 1675. The precepts of Sydenham were never reduced to practice in his day; but about fifty-seven years after his work *On Acute Diseases* was published, the idea was taken up and acted upon by Franciscus Boissier de Sauvages, a distinguished physician and eminent professor of medicine at Montpellier. He attempted to arrange diseases, as botanists have done plants, into classes, orders, and genera. He endeavoured to lay down the characteristic phenomena of each, and to enumerate their principal varieties. The outlines of his nosological system were first published in 1732, and followed thirty years afterwards by his *Nosologia Methodica*—a work which marks an important era in the history of Medicine, as having led to much greater accuracy in the distinction of diseases than was previously observed.

At present the only useful method of defining diseases seems to be an artificial one. It is assumed by Nosologists that the proper foundation for the distinction of particular diseases is the occurrence of constant and uniform combinations of morbid phenomena or symptoms, presenting themselves in concurrence or in succession. Thus some of the essentials of a definition are obtained, so that each disease may be marked out by such a brief enumeration of its leading characters as might serve to distinguish it from every other. A series of nosological definitions more or less correct may be thus established, so that the same things are designated by the same terms. Objections have been urged to methods of this kind, on the ground that diseases are unsteady and variable

in their character; but the aids to science are now so numerous that physicians are becoming more and more able to distinguish diseases from one another, and to tell by what marks, or upon what grounds, they do so distinguish them. Such are the marks or grounds of distinction by which each disease ought to be defined; and as often as we attempt to establish a distinction among diseases, either the deficiencies or the errors of our definitions will be the more easily perceived; and the attempt will lead to a more accurate consideration of observations previously made, as well as to a greater degree of accuracy in subsequent observations. Definitions of diseases are therefore not only of much service to methodical nosology, but they help to render the diagnosis of diseases more perfect. Pathologists, however, are not agreed as to whether the definitions of diseases should be derived from the external phenomena that present themselves in their course, or from the internal pathological conditions on which these phenomena are supposed to depend; and particularly such of these conditions as consist in lesions or structural alterations discoverable after death.

Cullen was in favour of definitions derived from the symptoms; but he believed that the information derived from pathological anatomy might guide to correct distinctions among diseases. Defining diseases by their supposed proximate causes may lead to error, inasmuch as in many cases these causes are disputable, and may long continue to be so. Whatever principle of defining diseases be adopted, it is absolutely necessary that it should be independent of every theoretical view; for any theory employed, however specious, however much we may be persuaded of its truth, may not appear in the same point of view to others, and may therefore occasion endless confusion (CULLEN). If no uniform principle can be laid down for arriving at precise definitions of disease, we must be content with such methods of definition as will serve the main purpose of coupling intelligible general notions regarding the disease with given modes of expression. For example, although we cannot give such a definition of many a disease as will embrace even all the leading phenomena of every case, we may assuredly give such a definition as shall apply with reasonable accuracy to the disease we intend to designate, so that no one may suppose we mean thereby either *small-pox* or the *gout*, when we mean *typhus fever* or *dysentery*.

II. The Nomenclature of Diseases.—This, the second object of Nosology, has given rise to many disputes, and has furnished much scope for the display of classical erudition. From the earliest periods of medicine the names imposed upon diseases have been derived from several different sources; but the following considerations have generally regulated the naming of a disease:—*First*: Some names have been taken from the part affected—*e.g.*, *peripneumonia*, *podagra*, *ophthalmia*, *dysentery*. *Secondly*: The most characteristic symptoms have furnished the name—*e.g.*, *ileus*, *tenesmus*, *paralysis*, *diarrhœa*, *dyspnœa*, *coma*. *Thirdly*: Some names have been taken from these two circumstances combined—*e.g.*, *cephalgia*, *otalgia*, *cardialgia*, *odontalgia*, *hysteralgia*. *Fourthly*: An alteration of tissue upon which subsequent changes depend being recognized as the essential element of the disease, it is named accordingly—*e.g.*, *pleuritis*, *peritonitis*. *Fifthly*: Such alteration not being discovered, the first tangible link in the chain of causation has been used instead—*e.g.*, *melancholia*, *cholera*, *typhus*. *Sixthly*: When a lesion tending to sudden death at once follows the application of a cause, that cause may name the disease—*e.g.*, *lightning*, *prussic acid*, *arsenic*, *burn*, *scald*, *sun-stroke*, *cut*, *stab*, *frost-bite*, &c. *Seventhly*: A considerable number of names of diseases have been derived from some imaginary resemblance to external objects—*e.g.*, *elephantiasis*, *cancer*, *polypus*, *anthrax*, &c. *Lastly*: There are still many names, the origin of which it is not now easy to trace.

It is obvious, from these statements, that the names of diseases must change as our knowledge changes and becomes more precise; and many diseases which were once named after their symptoms are now called according to the lesion from which most of those symptoms proceed. An apt illustration of this is to be found in *paralysis*, which is no longer regarded as a disease *per se*, but is merely a symptom of several structural alterations of the brain and spinal marrow; and so also *diarrhœa*, which now ought to be almost excluded as a disease from tables of the causes of death.

The progress made in our knowledge of disease from time to time rendered it obvious that some diseases, now only sufficiently recognizable, are different from any other diseases hitherto known. In separating them it became necessary to invent new names for

the distinct diseases, or a choice had to be made from amongst those names previously in use. Hence the jumble of Greek, Latin, and mongrel names which pervades medical nomenclature. The idea also of rendering medical nomenclature *uniform*, by deriving the names of diseases from one source only, or from a certain or mixed combination of sources, has caused many to attempt the reform of medical nomenclature, and especially since morbid anatomy has been so much prosecuted, that it might serve as a useful guide in distinguishing the disease or dictating its name.

By some it is maintained that "the name of each disease or species should be so characteristic and significant, that a person slightly acquainted with the language and the subject should, on hearing it, immediately understand what is the nature of the disease it designates" (PLOUCQUET). In this respect the name ought to be composed out of the same elements as the definition of the disease—in fact, it ought to be the definition converted into a name, and derived either from the symptoms of the disease or from the supposed proximate cause. But a name which is expressive only of the nature, seat, or proximate cause of a disease may be erroneous in respect of each of these facts singly, or of all of them together. The history of the nomenclature of fever, especially typhoid, would amply illustrate these statements—*e. g.*, putrid fever, adynamic fever, bilious fever, pythogenic fever, enteric fever, meningo-gastric fever, nervous fever, gastric fever, are mild examples of nomenclature and of confusion which ought to make a man pause before he attempts to construct a new name. It is inexpedient, also, to abandon (except when unavoidable) the names of distinct diseases received and recognized by our forefathers in the science; or of substituting new ones in their place, without an extreme necessity. Sauvages insists much on this point, and Cullen was of the same opinion. "Words," says the former, "are good only in respect of their signification." In dealing, therefore, with ancient nomenclature, which, for the time being, may appear objectionable, it is surely better to extend, if possible, the signification of the word, name, or term, than to alter it. At the same time, it must always be permitted to give new names to new diseases, and to select the best out of those which are in use, when a great number have been used to designate one and the same thing. There are some principles, therefore, which it is well to recognize as influencing the

judicious choice of a name. Such names, for example, as involve or attempt to indicate a proximate cause are more liable to lead to error than those which are derived from leading symptoms. If names were to be based on supposed causes, new names of diseases would be required whenever a new hypothesis is started. Look, for example, at the names of typhoid fever, already mentioned, and the systems of Linnæus, Vogel, Pinel, and even Mason Good, will show that medical nomenclature has been repeatedly changed without any urgent necessity; and great inconvenience has especially resulted from incorporating particular and often peculiar pathological doctrines with the language and nomenclature of diseases. So much has this been the case that the language of medical science has been in danger of becoming "a curious mosaic of the chief speculations of ancient and modern times." The passion for inventing new terms retards also, in a wonderful degree, the progress of the student of medicine, and tends to involve him in difficulty and doubt.

III. The Classification of Diseases.—From time to time physicians have considered it advisable or advantageous to arrange the whole of the diseases they are able to define, and to name, under more or less comprehensive groups. A consideration of the different plans which may be pursued in such arrangements, and of the advantages to be derived from them, forms the third object of nosology.

It is obvious that any single character, or combination of characters, in respect of which diseases agree with or differ from each other, may be made the basis of methodical arrangement, under a larger or smaller number of divisions, or of higher or lower genera (language of logicians), or of classes, orders, and genera (language of naturalists). By ingenious devices of the mind the physician or the statist may classify and arrange his knowledge so as to bring it all more readily within his reach for any special purpose,—so as to make it, in fact, more at his disposal—to facilitate and pave the way for further investigation. Such are the legitimate objects and the results of all methodical arrangements. Classification, therefore, being only a method of generalization, there are, of course, several classifications of disease which may be used with advantage for special purposes. The physician, the pathologist, the jurist, the hospital statist, may each legitimately classify diseases from his own point of view, and for his own purposes,

in the way that he thinks the best adapted to facilitate his inquiries, and to yield him general results. The medical practitioner may found his main divisions of diseases on their treatment, as medical or surgical; the pathologist, on the nature of the morbid action or product; the anatomist or the physiologist, on the tissues and organs involved; the medical jurist, on the suddenness or slowness of the death; the hospital statist, on the kind of diseases which are treated in its wards; and all of these points of view may give useful and interesting results (FARR).

There is thus no question on which more diversified opinions are legitimately entertained than on that of classification. Although it is the aim of all systematic writers and observers to arrange the objects of study in the most natural order possible, and although diseases are named as if they were individual entities, yet they present so great varieties that they will not admit of that definite and, in many respects, natural species of classification which can be made with objects of natural history. Manifest reasons of convenience and facility for work can therefore be assigned as the great incentive to classification; and numerous reasons exist for classifying diseases in various ways:—(1.) Men differ in their estimation of the characters on which different arrangements may be founded. (2.) The facts and phenomena of diseases on which classifications may be made are not all regarded from the same point of view. Most systems are avowedly *artificial*, being arranged with the view to elucidate or support a theory, or otherwise to effect a definite end. For example, by classifying diseases and recording the causes of death, the most valuable information is obtained relative to the health of the people, or of the unwholesomeness and pestilential agencies which surround them. “We can take this or that disease, and measure not only its destructiveness, but its favourite times of visitation; we can identify its haunts and classify its victims.” We are able to trace diseases also as they perceptibly get weaker and weaker, or otherwise change their type, as some have done from time to time. We know from the valuable returns of the registrar-general, prepared periodically by Dr. Farr, that certain diseases are decreasing, or growing less and less destructive; that certain other diseases have ceased in some measure; while other severe diseases have exhibited a tendency to increase. The advantages, therefore, of

adopting some system of classifying diseases, which can be put to such useful practical purposes, must be obvious to every one.

To some extent other systems are *natural* in their arrangement, in so far as they attempt to express or exhibit some of the natural relations which subsist among diseases; but the mere expression of one man's interpretation of peculiarities of disease of the same species, and the elevation of such diseases in a classification as specifically distinct, are apt to be based on insufficient evidence as regards natural relations.

Principles of Classification.—Many systems of Nosology have been adopted from time to time; and as valuable general principles have been adduced from some, the grounds on which diseases have been classified may be briefly described under the following eight divisions, namely:—

I. *The nature of the ascertained causes of disease.* On this principle two classes of diseases are recognized, namely,—(1.) Diseases arising from general causes; (2.) Diseases arising from specific causes.

II. *The pathological states or conditions which attend diseases.* The principle of this classification consists in determining alterations of the structure or the chemical composition of parts, from which names are given to the disease—*e.g.*, pleuritis, pneumonia, &c. The distinctions of Sauvages were generally derived from symptomatic and pathological characters, or external symptoms alone; Cullen following (1792), adopted similar grounds of classification; but with much more comprehensive views than Sauvages, a more lucid order, and a happier simplicity, he excelled in accuracy of definitions all who had gone before him. His descriptions of disease received no colouring from his theories. They are faithful to nature, consistent with the knowledge of his day; and, greatly in advance of his time, his original and inventive mind dwelt much on the causes of disease in all his reasonings and explanations on medical subjects. Aware, however, of the imperfections of the Art of Medicine, he did not attempt to arrange diseases according to their proximate causes, but according to a method founded partly on their symptoms, partly on their causes, and partly on their seats (CURRIE). A methodical arrangement of this kind has generally been considered the most desirable, as being likely to bring together diseases corresponding not only in some very important relations as regards their symptoms, but

also in the indications and means of treatment which they suggest and require. But it is obvious that such an arrangement must vary according to the progress of knowledge and of opinion; for a disease which may at present be supposed to depend upon one pathological condition may be found at a future time to proceed from another. Besides, the arrangement involves a principle which tends to separate diseases bearing a striking resemblance to one another in their external phenomena, though depending on different pathological conditions; for example, different species of apoplexy and epilepsy. It is an arrangement, also, which brings together diseases which, though belonging to the same natural family, may be respectively characterized by groups of symptoms that do not bear any very obvious resemblance. Thus the hæmorrhages at once bring together apoplexy and hæmoptysis in this classification.

III. *The properties, powers, or functions of an organ or system of organs being deranged*, dictates a classification in which the most prominent effects or phenomena of morbid states are considered as the disease—*e. g.*, palpitation, diarrhœa. It is an arrangement which brings diseases into approximation with one another according to the part of the body principally affected and the function principally disturbed.

When disease consists in perverted powers or functions it is then denominated a *dynamic* affection or disorder. When it depends on change of structure it is termed an *organic* lesion or disease.

This third basis of classification is Physiological, and was adopted by Drs. Young and Mason Good in imitation of Ploucquet of Tübingen. It has been the most popular arrangement of diseases, and perhaps the best adapted for lectures, or for treatises on the practice of physic, because it brings together the different diseases of the same organ, and of those organs most intimately related to one another; but, to profit by the arrangement, the student must be previously instructed in the general doctrines of disease.

IV. The diseases comprehended under the two latter principles of classification are sometimes inaccurately and loosely brought together under the heads of *Structural* and *Functional* diseases. The diseases of function, for instance, being made to embrace the *neuroses*, *hæmorrhages*, and *dropsies*; while *inflammation*,

tubercle, cancer, melanosis, hypertrophy, and atrophy, are the subordinate classes of the diseases of structure. The diseases of function embrace all those diseases in which the action, the secretion, or the sensation of a part is impaired, without any primary alteration of structure of the organ or tissue affected, so far as our imperfect means of research can ascertain. Thus, *mania, catalepsy, neuralgia*, are *neuroses* of the brain or other portions of the nervous system. *Colic, vomiting, diarrhœa, and constipation*, are *neuroses* of the alimentary canal; and so on of other parts. *Hæmorrhage*, or the effusion of blood, and *drop-sies*, or an effusion of water into the shut cavities of the body, as that of the head, chest, or abdomen, are also instances of functional disease. Such are the grounds of classification adopted by the late Dr. Williams, of St. Thomas's Hospital, London.

V. A basis of classification has been adopted, founded on *the pathological nature of the different morbid processes*, but the arrangement of the orders and subdivisions are determined by the anatomical arrangement of the textures and organs of the animal body, as originally developed by Bichat.

Such is the principle and mode of classification adopted by Dr. Craigie (1836).

VI. A ground of classification exists, having reference to *the general nature and localization of the morbid states*. It comprehends three classes,—(1.) Diseases which occupy the whole system at the same time, and in which all the functions are simultaneously deranged. These have been named general diseases, such as *fevers*. (2.) Constitutional affections, meaning thereby diseases which display themselves in local lesions in any part, or in several parts of the system, but not in all parts at the same time—*e.g., rheumatism, gout*. (3.) Local morbid processes.

Such is the classification adopted by Dr. Wood, of Pennsylvania (1847).

VII. Applying the principles of a *purely humoral pathology*, we have a classification consisting of,—

a. Fevers. b. Dyscrasiæ—e.g., tabes, chlorosis, scorbutus, dropsy, diabetes, pyæmia, tuberculosis, carcinoma. c. Constitutional diseases, induced by,—(1.) Specific agents; (2.) Vegetable substances.

Such is Wunderlich's arrangement of diseases (1852).

VIII. M. de Savignac, Professor of Clinical Medicine at the Naval School of Toulon, has recently (1861) propounded a Nosological arrangement (which he considers a natural one) founded on what he believes to be the "elements" of disease. His so-called "elements" seem to be vague general expressions, or names to denote the leading phenomena of diseases, or the unknown cause of such phenomena. To each of the classes he so defines, the question would at once suggest itself, and require solution, as to what the "element" may be on which the particular class is made to stand alone. At first sight, the doctrine of "elements" in disease is sufficiently complex, but the application of the doctrine by Professor Savignac is simple enough, and is made to give an appearance of shape and completeness to a systematic arrangement. He merely subjoins the word "element" to an adjective formed from the name of each class of diseases. Thus the class *Neuroses* is distinguished by the *neurotic element*; the class *Rheumatismæ*, by the *rheumatic element*; the class *Dyscrasiæ*, by the *dyscrasic element*, and so on to the number of fourteen classes. In the formation of orders, genera, or groups of diseases under this classification, no fixed principle can be recognized.

None of these eight principles of classification lead to a perfectly philosophical or purely natural classification, because diseases are not yet sufficiently understood to permit us to see clearly their mutual relations; and the best recommendation of any one of them would be a negative one, namely, that of doing the least possible violence to our very imperfect knowledge regarding the natural affinities or alliances of diseases, of which we have at present only a sort of instinctive recognition. But the tendency of modern investigations by the varied instruments and methods of research, proves that many diseases hitherto supposed to be altogether functional, are really accompanied with changes of structure, either of an anatomical, physical, or chemical kind. It is, therefore, not unreasonable to anticipate that all the so-called functional maladies will be found to depend upon some concomitant alteration of structure; and when we are unable to detect an alteration either of the solid or fluid parts of the body, in cases where the existence of disease cannot be doubted, we may attribute our failure to the imperfection of our means and instruments of observation, or our modes of using them. In the

present state of our knowledge, however, there are diseases which have baffled the attempts of the morbid anatomists to associate them with structural changes of a characteristic or constant kind. Some convulsive diseases of the nervous system are of this class.

In the present imperfect state of our knowledge, therefore, diseases cannot be philosophically classified, nor arranged according to natural or true relations, dependencies, or alliances. Nevertheless, a great advantage inevitably results from the institution of nosological classes and orders, on account of the necessity which every such attempt imposes on those who engage in it, of marking very accurately the characteristic phenomena of particular diseases; and every one acquainted with the progress of natural history must know that the study of details, and the repeated attempts to systematize them, have mutually promoted and supported each other. It is the same with regard to diseases, as Cullen justly observed; and if a Methodical Nosology cannot be rendered perfect, it is a certain proof that for the time being the details of which it must be composed are neither accurate nor complete, and are not likely to be so till attempts to observe, investigate, and systematize have made some farther progress. Every attempt to reduce to system tends to enlarge our stock of facts; and though we may fail to obtain a perfectly philosophical arrangement, yet the very attempt to attain it must be of advantage, by leading to useful discussions regarding the Pathology and History of diseases (CULLEN). No one could be more convinced than Cullen was, that "perfect division and definition is the summit of human knowledge in every department of science, and requires not only the clearest, but the most comprehensive views, such as, with respect to diseases, we can arrive at only by often repeated attempts and much study." A no less distinguished pathologist—M. Bayle—in discussing the difficulties connected with classification, recommends us "to follow the plan which presents fewest imperfections, remembering that the determination of specific characters is what is most essential in Nosology, arrangement being the least important; for each arrangement will have its defects, will present its deficiencies, and exhibit some forced approximations." Every plan of arrangement ought, therefore, to be accepted for what it is worth, and appreciated at its true value; namely, as to how far it fulfils

the object for which it was mainly devised. Cullen, also, in his lectures and in his writings on this subject, everywhere speaks with the utmost modesty and diffidence, and endeavours at all times to impress upon the mind the fact that Nosology, like other branches of medical science, must necessarily be progressive in its advancement; and that it is only by frequent and multiplied trials that it can be brought to any degree of perfection.

A perfectly philosophical or natural system of classification aims at having the details of its plan to agree in every respect with the facts as they exist in nature, and to be as it were a "translation of the thoughts of the Creator into the language of man." To effect this end, arrangements, as they *naturally* exist, require to be traced out, not devised. The tracts in which such a pursuit must be followed up, and in which our knowledge is as yet deficient, may be shortly indicated under the following heads, namely:—

(1.) The affinities or alliances of diseases with each other. (2.) The morbid anatomy of diseased parts. (3.) The communication, propagation, inoculation, generation, development, course, and spontaneous natural termination of diseases. (4.) The connection of the phenomena recognized during life with the facts of morbid anatomy. (5.) The geographical distribution of diseases. (6.) The succession of diseases, so far as they can be traced through past ages; the peculiarities they have exhibited at different periods in the world's history, or within comparatively recent cycles of years.

But the time has not yet come for a classification on a basis so comprehensive; simply because the material does not yet exist; and attempts made to make so-called *natural* systems of arrangement must end in disappointment, on account of the uncertain and fluctuating data on which they must be based. Such attempts are apt to suggest the serious question, "Whether such Nosology promotes or retards the progress of Medicine?"

Present State and Aim of Nosology.—The most distinguished physicians and statisticians now living are at present lending their joint aid to obtain a nomenclature and classification of diseases which can be applied to the wants of the civil and military population in every country. Our eminent statistician, Dr. William Farr, devised a system of Nosology which has been discussed at

several meetings of the Statistical Congress of the Great Powers of Europe, convened for the purpose, amongst other business, of devising and adopting an uniform system of nomenclature for recording diseases and the causes of death from them. Convened by the Government of the Emperor of the French, the Congress met in Paris on the 10th of September, 1855, when a nomenclature of the causes of death was agreed upon, essentially the same as that used in England and Geneva. Subsequent arrangements were made at a second Congress, held at Brussels, to hold a third at Vienna. At that third Conference, in 1857, a *nomenclature* substantially uniform was agreed upon for adoption in all the states of Europe; and fatal cases were to be registered on an uniform plan. A definite *classification*, however, is still undetermined; but a classification nearly the same as the English one has been adopted in Bavaria, and seems to be making its way among practical men in Germany. The same classification and nomenclature have been recently adopted in America. The Austrians also seem to approve of the separation of the *zymotic* diseases from the others.

The War Office of this country, in the statistical changes recently introduced into the Army Medical Department, has adopted the *nomenclature* of diseases agreed upon at these International Conferences, together with the *classification* used by the Registrar-General of England, Scotland, and Ireland.

This nomenclature and classification is given in the succeeding chapters. It is adopted simply because it is at present practically the most useful Nosology; because its *nomenclature* has been agreed upon as that to be used in every country of Europe; because it has been ordained to be used by the War Office authorities of our own country, in the Medical Returns of Her Majesty's British and Indian armies; because its practical bearings tend to elucidate great and comprehensive questions connected with public health, as well as many practical questions relating to diseases; because it tends to demonstrate on a great scale conditions that are injurious or fatal to the life of man; and because, by thus pointing out such conditions, it contributes to remove the evils which tend to shorten human life in town and country, and impair the strength of our Armies and our Fleet. Yet with all these advantages the system, like every possible system, has its defects, especially when employed in any attempt

to group together diseases which, though rarely proving fatal, occasion a great amount of sickness, consequent inefficiency, and losses of strength among bodies of men. Diseases also are undoubtedly grouped together in it which have no natural alliance. *Diabetes* is not necessarily a disease of the kidney; neither are *phymosis*, *paraphymosis*, *stricture* of the *urethra*, and *orchitis* necessarily *enthetic* diseases; or *tonsillitis* and *parotitis* necessarily *miasmatic*. Diseases also, whose pathological natures are certainly similar, are widely separated—some surely inadvertently—for example, *gout* and *rheumatism*. These two diseases were brought together in the previous edition of this work, under “constitutional diseases,” and will be again considered together under this head.

Although practical medicine will never submit to be fettered by strict nosological distinctions, yet in studying the Science of Medicine systematically, a METHODICAL NOSOLOGY ought to be regarded as a table of reference to aid the student in naming diseases, and so preserving uniformity in his records and diagnosis, and a system to guide him generally in acquiring a knowledge of his profession, especially with reference to the practical questions of the day. The Nosology of Dr. William Farr ought, therefore, to be accepted simply as a contrivance to aid us in giving the same name to similar conditions of disease, in the belief that a system of some kind is better than no system whatever, more especially if the defects of the particular system adopted are understood and explained. Pathology, we know, is yet too young to base a scientific classification upon; but as the science advances, so must Nosology. One great step indeed has been accomplished; for notwithstanding the differences of doctrine which prevail in the Science of Medicine, there is at present an agreement all over Europe to designate diseases uniformly; and thus far Nosology is of indispensable use in reference to the *definition* and *nomenclature* of diseases. But on the one hand, there are many nice questions which always will arise relative to the nature of diseases, on which it is in vain to expect physicians and statisticians to agree unanimously; and therefore no perfect system even of naming, far less of classifying, the diseases of mankind can we ever hope to see realized. On the other hand again, we have every reason to hope that, by the numerous inquisitive researches of the day, Pathology and Nosology will

grow even more rapidly than it has hitherto done. The mere enumeration of diseases has almost doubled since Cullen's Nosology was written; while our knowledge of facts relating to disease has greatly more than doubled. Cullen's Nosology became effete and useless at last, under the pressure of increasing knowledge acquired and effected with resources very inferior to those we now possess, and far less extensive. So we may legitimately entertain the hope that the present Statistical Nosology here adopted will sooner fall into disrepute than even Cullen's did, because there is every reason to expect that pathological knowledge will extend more rapidly than it has hitherto done.

Looking, therefore, to the experience of the past, it cannot with any reason be urged that systematic arrangements, if consistent with existing knowledge, ever cramp or hamper a man in carrying out scientific investigations; on the contrary, they enable him to see more clearly in what direction his labour must be advanced, and demonstrate more forcibly than otherwise the deficiencies of his knowledge.

CHAPTER II.

TABULAR VIEW OF THE CLASSES AND ORDERS OF DISEASES ACCORDING TO THE NOSOLOGY OF DR. FARR.

CLASS I.—Zymotic Diseases. *Zymotici* (ζύμη, leaven)—Diseases that are either epidemic, endemic, communicable, inoculable, or capable of propagation or generation; induced by a specific material, which may be named a *poison*, or by the want of food, or by its bad quality. In this class there are four orders of diseases, namely:—

ORDER 1. **MIASMATIC DISEASES**—*Miasmatici* (μίasma, stain, defilement).

ORDER 2. **ENTHETIC DISEASES**—*Enthetici* (ἐνθετός, put in, implanted).

ORDER 3. **DIETIC DISEASES**—*Dietici* (δίαίτα, way of life, diet).

ORDER 4. **PARASITIC DISEASES**—*Parasitici* (παράσιτος, parasite):

CLASS II.—Constitutional Diseases. *Cachectici* (καχεξία, ill-health, bad habit of body)—Sporadic diseases; affecting several organs in which new morbid products are often deposited. These diseases are sometimes hereditary, and developed in the course of nutrition and processes of life; but they are not capable of direct propagation, communication, inoculation, or generation.

ORDER 1. DIATHETIC DISEASES—*Diathetici* (διάθεσις, condition, diathesis).

ORDER 2. TUBERCULAR DISEASES—*Phthisici* (φθισίς, wasting away).

CLASS III.—Diseases in the course of which Lesions tend to be localized. *Monorganici* (μόνος, alone, without others; ὄργανον, organ)—Sporadic diseases in which the functions of particular organs or systems are disturbed or obliterated, with or without inflammation; sometimes hereditary.

ORDER 1. BRAIN DISEASES—*Cephalici* (κεφαλή, head).

ORDER 2. HEART DISEASES—*Cardiaci* (καρδιά, heart).

ORDER 3. LUNG DISEASES—*Pneumonici* (πνεύμων, lung).

ORDER 4. BOWEL DISEASES—*Enterici* (έντερον, intestine).

ORDER 5. KIDNEY DISEASES—*Nephritici* (νεφρός, kidney).

ORDER 6. GENNETIC DISEASES—*Aidoici* (αἰδοία, pudenda).

ORDER 7. BONE AND MUSCLE DISEASES—*Myostici* (μῦς, muscle; ὀστέον, bone).

ORDER 8. SKIN DISEASES—*Chrotici* (χρῶς, skin).

[ORDER 9. EYE DISEASES.]

[ORDER 10. EAR DISEASES.]*

CLASS IV.—Developmental Diseases. *Metamorphici* (μεταμόρφωσις, change of form)—Special diseases, the incidental result of the formative, reproductive, and nutritive processes.

ORDER 1. DEVELOPMENTAL DISEASES OF CHILDREN—*Paidici* (παιδία, youth).

ORDER 2. DEVELOPMENTAL DISEASES OF WOMEN—*Gyniaci* (γυνή, woman).

ORDER 3. DEVELOPMENTAL DISEASES OF OLD PEOPLE—*Geratici* (γῆρας, old age).

ORDER 4. DISEASES OF NUTRITION—*Atrophici* (ἀτροφία, atrophy).

* New names, or names transposed by the author, have been put within brackets.

CLASS V.—Lesions from Violence tending to sudden Death. *Thanatici* (θάνατοι, violent deaths). These lesions are the evident and direct results of physical or chemical forces, acting either by the will of the sufferer, of other persons, or accidentally.

ORDER 1. ACCIDENT—*Tychici* (τύχη, chance).

ORDER 2. BATTLE—*Polemici* (πόλεμος, a battle, fight).

ORDER 3. HOMICIDE—*Androphonici* } (άνήρ, man; αὐτὸς, self ;

ORDER 4. SUICIDE—*Autophonici* } φονεύω, I murder, kill).

ORDER 5. EXECUTION—*Demiotici* (δημῳρτης, executioner).

ORDER 6. PUNISHED.

CHAPTER III.

TABULAR VIEW OF THE CLASSES, ORDERS, AND NOMENCLATURE OF DISEASES.

CLASS I.—Zymotic Diseases. *Zymotici*.

ORDER 1. MIASMATIC DISEASES—*Miasmatici*.

LATIN NAMES.	ENGLISH NAMES.	FRENCH NAMES.	GERMAN NAMES.
<i>Variola</i> .	Small-pox.	Variole.	Wahre oder Menschen-
<i>Varioloides</i> .	Modified ditto.	Varioloide	pocken, oder Men-
			schen-Blattern.
<i>Varicella</i> .	Chicken-pox.	Varicelle.	Wasser-Blattern.
<i>Miliaria</i> .	Miliary fever.	Miliaire.	Friesel.
<i>Morbilli</i> .	Measles.	Rougeole.	Masern.
<i>Scarlatina</i> .	Scarlet fever.	Scarlatina.	Scharlach Fieber.
Angina Maligna is included in Scarlatina.			
<i>Tonsillitis</i> .	Quinsy.	Esquinancia.	Mandelbräune.
<i>Diphtheria</i> .	Diphtheria.	Diphthérie.	Rachencroup.
<i>Parotitis</i> .	Mumps.	Oreillon.	Ohrdrüsenbräune.
<i>Cynanche trachealis</i> .	Croup.	Croup.	Croup.
<i>Pertussis</i> .	Whooping-cough.	Coqueluche.	Keuchhusten.
<i>Febris Typhoides</i> .	Typhoid fever.	Fièvre typhoïde.	Nervenfieber.
„ <i>Recurrentis</i> .	Relapsing fever.	—	—
„ <i>Typhus</i> .	Typhus fever.	Typhus.	Typhus.
„ <i>Intermittens</i> .	Ague.	Fièvre Intermittente.	Wechselfieber.
„ <i>Remittens</i> .	Remittent fever.	„ Rémittente.	Remittent-Fieber.
„ <i>Icterodes</i> .	Yellow fever.	„ Jaune.	Gelbes Fieber.
„ <i>Continua</i> .	Continued fever.	Synoque.	—
Cases of Fever arising from Intemperance are not to be included under this head, but are to be entered as <i>Ebriositas</i> (Class I., Order 8),			
<i>Ophthalmia</i> .	Ophthalmia.	Ophthalmie.	Augenentzündung.
<i>Erysipelas</i> .	Erysipelas.	Erysipèle.	Rose, Rothlauf.
<i>Erythema</i> .	—	Erythème.	Röthe.

LATIN NAMES.	ENGLISH NAMES.	FRENCH NAMES.	GERMAN NAMES.
Pyæmia.	Purulent infection.	Pyohémie.	Eiterfieber.
Gangræna nosocomialis.	Hospital gangrene.	Gangrène d'hôpital.	Hospitalbrand.
Metria.	Childbed fever.	Fièvre puerperale.	Kindbettfieber.
Pestis.	Plague.	Peste.	Pest.
Anthrax.	Carbuncle.	Anthrax Malin.	Carbunkel.
Furunculus.	Boil.	" benin.	Blutgeschwür.
Influenza.	Influenza.	Grippe.	Grippe.
Dysenteria.	Dysentery.	Dysenterie.	Ruhr.
Diarrhœa.	Diarrhœa.	Diarrhée.	Durchfall.
Cholera biliosa.	Cholera.	Cholera.	Cholera.
" spasmodica.	Asiatic cholera.	—	—

ORDER 2. ENTHETIC DISEASES—*Enthetici*.

Syphilis primaria.	Primary syphilis.	Syphilis primitive.	Primäre Syphilis.
" secundaria.	Secondary syphilis.	" secondaïre.	Secundäre Syphilis.
Iritis syphilitica.	Inflammation of the Iris.	Irite.	Entzündung der Regenbogenhaut.
Gonorrhœa.	Gonorrhœa.	Gonorrhée.	Tripper.
Phymosis et paraphymosis.*			
Bubo.	Bubo.	Bubon.	
Orchitis.	Swelled testicle.	Orchite.	Hodenentzündung
Stricture Urethræ.	Stricture.	Uréthrosténie.	Verengung der Harnröhre.
Equinia.	Glanders.	Morve.	Rotz.
Rabies.	Hydrophobia.	Hydryphobia.	Wasserscheu.
Necusia.	Infection by puncture in dissection.	Infection par piqué de dissection.	Sections gift oder Wunden.
Pustula Maligna.	Malignant pustule.	Pustule Maligne.	Milzbrandcarbunkel.
Lepra.	Leprosy.	Lépre.	Aussatz.

ORDER 3. DIETIC DISEASES—*Dietici*.

Febris à fame.	Famine fever.	Fièvre de Faim.	Hungerfieber.
Scorbutus.	Scurvy.	Scorbut.	Scorbut.
Purpura.	Land Scurvy.	Purpura.	Purpura oder Blutflecken Krankheit.
Rachitis.	Rickets.	Rachitisme.	Englische Krankheit.
Bronchocele.	Bronchocele.	Bronchocele.	Kropf.
Cretinismus.	Cretinism.	Cretinisme.	
Ergotismus.	Ergotism.	Ergotisme.	Mutterkornvergiftung.
Ebriositas.	Intemperance.	Alcoholisme.	Trunksucht oder Säuferydyskrasie.

ORDER 4. PARASITIC DISEASES—*Parasitici*.

Aphthæ.	Thrush.	Aphthæ.	Schwämmchen.
Porrigo.	Scaldhead.	Porrigo.	Kopfgrind.
Scabies.	Itch.	Scabies ou Gale.	Krätze, Milbenkrätze.
Phthiriasis.	Morbus pedicularis.	Phthiriase.	Läuseucht.
Vermes.	Worms.	Entozoaires.	Wurmsucht.
Acephalocystis, echinococcus, hominis.	Hydatids.	Hydatides.	Hydatiden, Echinococcus.

* If the result of Gonorrhœa.

LATIN NAMES.	ENGLISH NAMES.	FRENCH NAMES.	GERMAN NAMES.
<i>Tænia Solium.</i>	Tape worm.	Ténia (ver solitaire).	Bandwurm.
<i>Strongilus Gigas.</i>	—	Strongle géant.	—
<i>Ascaris Lumbricoidea.</i>	Round worm.	Ascaride lombricoïde.	Spulwurm.
<i>Ascaris Vermicularis.</i>	Thread worm.	„ vermiculaire.	Fadenwurm.
<i>Dracunculus.</i>	Guinea worm.	—	Guineawurm.

(See text for a more complete enumeration.)

CLASS II.—Constitutional Diseases. *Cachectici.*

ORDER 1. DIATHETIC DISEASES—*Diathetici.*

<i>Podagra.</i>	Gout.	Goutte.	Gicht.
[<i>Rheumatismus.</i>]	[<i>Rheumatism.</i>]	[<i>Rheumatisme.</i>]	[<i>Rheumatismus.</i>]
<i>Anæmia.</i>	—	Anhémie.	Blutarmuth, Bleichsucht.
<i>Anasarca.</i>	Dropsy.	Hydropisie.	Wassersucht.
<i>Carcinoma encephaloidea.</i>	Cancer (soft).	Cancer encephaloïde.	Encephaloid.
<i>Carcinoma alveolare.</i>	„ (colloid).	„ alvéolaire.	Alveolarkrebs.
<i>Carcinoma osteoides.</i>	„ (osteoid).	„ ostéolde.	Knochenkrebs.
<i>Carcinoma epitheliale.</i>	„ (epithelial).	„ épithélial.	Hautkrebs, Epithelisma.
<i>Scirrhus.</i>	„ (scirrhus).	Squirre.	Schirrhus.
<i>Melanosis.</i>	—	Mélanose.	Melanose, Schwarzer Krebs.
<i>Lupus.</i>	—	Lupus.	Wasserkrebs.
<i>Noma.</i>	Canker.	Noma.	—
<i>Gangræna senilis.</i>	Dry gangrene.	Gangrène sénile.	Trockner Brand.

ORDER 2. TUBERCULAR DISEASES—*Phthisici.*

<i>Scrofula.</i>	Scrofula.	Scrofula.	Scropheln.
<i>Abcessus Psoanus.</i>	Psoas abscess.	Abscès du Psoas.	Lendenmuskellabscess.
<i>Tuberculosis Mesenterica.</i>	Mesenteric disease.	Tuberculose.	Tuberculose Bauchfellentzündung.
<i>Peritonitis tuberculosa.</i>	Tubercular peritonitis.	Peritonite tuberculense.	—
<i>Phthisis Pulmonalis.</i>	Consumption.	Phthisie.	Schwindsucht.
<i>Hæmoptysis.</i>	Spitting of blood.	Hémoptysie.	Blutspeien.
<i>Meningitis tuberculosa.</i>	Tubercular meningitis.	Meningite tuberculense.	—

CLASS III.—Local Diseases. *Monorganici.*

ORDER 1. DISEASES OF THE NERVOUS SYSTEM—*Cephalici.*

<i>Meningitis.</i>	Inflammation of the membranes of the brain.	Meningite.	Meningitis.
<i>Encephalitis.</i>	Inflammation of the brain.	Encéphalite.	Gehirnentzündung und Acuter Wasserkopf.
(Including acute Hydrocephalus.)			
<i>Myelitis.</i>	Inflammation of the spinal cord.	Myélite.	Rückenmarkentzündung.
<i>Apoplexia.</i>	Apoplexy.	Apoplexie.	Schlagfluss, Nervenschlag.

LATIN NAMES.	ENGLISH NAMES.	FRENCH NAMES.	GERMAN NAMES.
Paralysis.	Palsy.	Paralyse.	Lähmung.
Paralysis agitans.	Shaking palsy.	—	Zitterkrampf.
Chorea.	St. Vitus' dance.	Chorée (danse de St. Guy).	Veitstanz.
Delirium Tremens.	Brain fever of drunkards.	—	Säuferwahnsinn.
Mania.	Madness.	Folie.	Manie.
Monomania.	Monomania.	Monomanie.	Monomanie.
Dementia.	Mental imbecility.	Démence.	Unsinnigkeit.
Epilepsia.	Epilepsy.	Epilepsie.	Fallsucht.
Hysteria.	Hysteria.	Hystérie.	Muttersucht.
Tetanus.	Lockjaw.	Tétanos.	Starrkrampf.
Convulsio.	Convulsions.	Convulsions.	Krämpfe.
Eclampsia.	—	Eclampsie.	Kramf der Gebärenden.
Larygismus.	—	Laryngisme.	—
Cephalæa.	Chronic headache.	Cephalée.	Kopfschmerz.
Neuralgia.	Neuralgia.	Néuralgie.	Neuralgie.
Cæcitas.	Blindness.	Cécité.	Blindheit.
Otitis.	Inflammation of the Ear.	Otite.	Ohrenentzündung.
Dysæcœa.	Deafness.	Surdité.	Taubheit.

ORDER 2. DISEASES OF THE CIRCULATORY SYSTEM—*Cardiaci*.

Carditis.	Inflammation of heart.	Cardite.	Herzentzündung.
Pericarditis.	Inflammation of membrane covering heart.	Pericardite.	Herzbeutelentzündung.
Endocarditis.	Inflammation of membrane lining heart.	Endocardite.	Endocarditis.
Morbus Valvularum Cordis.	Disease of valves of heart.	Maladies des valvules du cœur.	Klappenfehler.
Hypertrophia cordis.	Hypertrophy of heart.	Hypertrophie du cœur.	Herzhypertrophie.
Atrophia cordis.	Atrophy of heart.	Atrophie du cœur.	Herzatrophy.
Degeneratio cordis.	Fatty degeneration of heart.	Dégénérescence du cœur.	Fettige Herzentartung.
Aneurisma cordis.	Aneurism of heart.	Anévrisme du cœur.	Herzaneurisma.
Aneurisma „	Aneurism of „ The artery affected to be specified.	Anévrisme „	Aortenaneurisma.
Angina Pectoris.	Breast Pang.	Angine pectorale.	Brustbratine.
Syncope.	Fainting.	Syncope.	Ohnmacht.
Arteritis.	Inflammation of arteries.	Artérite.	Schlagaderentzündung.
Atheroma Arteriarum.	—	Athérome.	Atheroma.
Phlebitis.	Inflammation of veins.	Phlébite.	Venenentzündung.
Varix.	Varicose veins.	Varices.	Krampfadern.

ORDER 3. DISEASES OF THE RESPIRATORY SYSTEM—*Pneumonici*.

Epistaxis.	Bleeding at the nose.	Epistaxis.	Nasenbluten.
Laryngitis.	Inflammation of windpipe.	Laryngite.	Kehlkopfentzündung.
Œdema Glottidis.	—	Œdème de la glotte.	Stimmmentzündung.
Bronchitis.	Bronchitis.	Bronchite.	Luftrohrrentzündung.
Pleuritis.	Pleurisy.	Pleurésie.	Brustfellentzündung.

LATIN NAMES.	ENGLISH NAMES.	FRENCH NAMES.	GERMAN NAMES.
Hydrothorax.	Water in the chest.	Hydrothorax.	Brustwassersucht.
Empyema.	—	Empyème.	Empyem.
Pneumothorax.	—	Pneumothorax.	Luftbrust.
Apoplexia Pulmonalis.	Congestion of lungs.	Apoplexie pulmonaire.	Lungenschlag.
Pneumonia.	Inflammation of lungs.	Pneumonie.	Lungenentzündung.
Asthma.	Asthma.	Asthme.	Engbrüstigkeit.
„ Tritorum.	Grinder's asthma.	—	—
„ Metallicorum.	Miner's „	—	—
Emphysema.	—	Emphysème des p ^{ou} mons.	Emphysem.

ORDER 4. DISEASES OF THE DIGESTIVE SYSTEM—*Enterici.*

Glossitis.	Inflam. of tongue.	Glossite.	Zungenentzündung.
Stomatitis.	„ mouth.	Stomatite.	Mundentzündung.
Pharyngitis.	„ pharynx.	Pharyngite.	Schlundentzündung.
Œsophagitis.	„ gullet.	Œsophagite.	Speiseröhrenentzündung.
Gastritis.	„ stomach.	Gastrite.	Magenentzündung.
Enteritis.	„ bowels.	Entérite.	Darmentzündung.
Peritonitis.	Abdominal inflam.	Péritonite.	Bauchfellentzündung.
Ileus.	Iliac passion.	Ileus.	Darmgicht.
Obstipatio.	Constipation.	Constipation.	Verstopfung.
Intus-susceptio.	Invagination of bowel.	Intussusception.	Darmverschlingung Volvulus.
Hernia.	Rupture. Specify the particular kind of hernia.	Hernie.	Eingeweidebrüche.
Dyspepsia.	Indigestion.	Dyspepsie.	Dyspepsie.
Colica.	Colic.	Colique.	Kolik.
Hæmatemesia.	Vomiting of blood.	Hématémèse.	Blutbrechen.
Melæna.	—	Mélène.	Schwarze Krankheit.
Hæmorrhœia.	Piles.	Hémorrhoides.	Hämorrhoiden.
Fistula in Ano.	Fistula.	Fistule.	Fistel.
Splenitis.	Inflam. of spleen.	Splénite.	Entzündung der Milz.
Hepatitis.	„ liver.	Hépatite.	„ „ Leber.
Icterus.	Jaundice.	Ictère.	Gelbsucht.
Chololithus.	Gallstones.	Calcul biliaire.	Gallensteine.
Cirrhosis.	—	Cirrhose.	Cirrhose: granulirte Leber.
Ascites.	Abdominal dropsy.	Ascite.	Bauchwassersucht.

ORDER 5. DISEASES OF THE URINARY SYSTEM—*Nephritici.*

Nephritis.	Inflam. of kidneys.	Néphrite.	Nierenentzündung.
Ischuria.	Retention of urine.	Ischurie.	Harnverhaltung.
Diuresis.	Excessive secretion of urine.	Diurèse.	Unvermögen den Harn zu halten.
Enuresis.	Incontinence of urine.	Enuresie.	Unwillkürlicher Harnabgang.
Nephria.	Bright's disease.	Néphrine.	Bright'sche Krankheit.
Diabetes.	Diabetes.	Diabète.	Harnruhr.
Calculus vesicæ.	Stone in the bladder.	Calcul.	Steinkrankheit.
Lithiasis.	Gravel.	Gravelle.	Harngries.
Hæmaturia.	Bloody Urine.	Hématurie.	Blutharnen.

LATIN NAMES.	ENGLISH NAMES.	FRENCH NAMES.	GERMAN NAMES.
Cystitis.	Inflam. of bladder.	Cystite.	Blasentzündung.
Morbus Prostaticus.	Diseased prostate.	Prostatite.	Vorsteherdrüsenkrankheit.

ORDER 6. DISEASES OF THE GENERATIVE SYSTEM—*Gennitici*.

Varicocele.	Varicose veins of cord.	Varicocèle.	Krampfaderbruch.
Orchitis.	Inflam. of testicle.	Orchite.	Hodenentzündung.
	When not the result of Gonorrhœa.		
Hydrocele.	Dropsy of testicle.	Hydrocèle.	Wasserbruch.
Hysteritis.	Inflam. of womb.	Hystérite.	Gebärmutterentzündung.
Hydrops Ovarii.	Ovarian dropsy.	Ovarémie.	Eierstockwassersucht.
Tumor Ovarii.	" tumor.	Ovarite.	Eierstockgeschwülste.
Tumor Uteri.	Uterine "	Tumeur Utérine.	Uterusgeschwülste.
Polypus Uteri.	" polypus.	Polypes de l'utérus.	Uteruspolypen.

ORDER 7. DISEASES OF THE LOCOMOTIVE SYSTEM—*Myostici*.

Arthritis.	Inflam. of joints.	Arthrite.	Gliedersucht.
Synovitis.	Synovitis.	Synovite.	Gelenkkapselentzündung.
Hydrarthrus.	Dropsy of a joint.	Hydrarthre.	Gelenkwassersucht.
Contractura.	Contraction.	Contracture.	Contraktur.
Ostitis.	Inflammation of bones.	Ostéite.	Knochen- und Knochenhautentzündung.
Periostitis.	[Inflammation of Periosteum.]		
[Endoostitis.]	[Inflammation of medullary tissue of bones.]		
Exostosis.	Osseous tumor.	Exostose.	Exostose.
Caries.	Caries.	Carie.	Rückgrathverkrümmung.
Necrosis.	Necrosis.	Nécrose.	Knochenfrass.
Atrophia Musculorum.	Muscular atrophy.	Atrophie Musculaire.	Muskelatrophie.

ORDER 8. DISEASES OF THE INTEGUMENTARY SYSTEM—*Chrotici*.

Roseola.	Roseola.	Roséole.	Roseola.
Urticaria.	Nettleraah.	Urticaire.	Nesselfriesel.
Eczema.	Eczema.	Eczéma.	Eczen, Hitzbläschen.
Herpes.	Herpes.	Herpès.	Herpes, Flechte.
Pemphigus.	Pemphigus.	Pemphigus.	Pemphigus, Blasenausschlag.
Rupia.	Rupia.	Rupia.	Rupia.
Ecthyma.	Ecthyma.	Ecthyma.	Ecthyma.
Impetigo.	Impetigo.	Impetigo.	Impetigo, Postelflechte.
Acne.	Acne.	Acné.	Acne, Finne.
Mentagra.	Mentagra.	Mentagre.	Mentagra, Bartfinne.
Lichen.	Lichen.	Lichen.	Schwindknötchen.
Prurigo.	Prurigo.	Prurigo.	Hautjucken.
Psoriasis.	Psoriasis.	Psoriasis.	Schuppengrind.
Pityriasis.	Dandriff.	Pityriasis.	Hautkleie.
Ichthyosis.	Ichthyosis.	Ichthyose.	Fischhaut.
Phlegmon.	Phlegmon.	Phlegmon.	Phlegmon.

LATIN NAMES.	ENGLISH NAMES.	FRENCH NAMES.	GERMAN NAMES.
Paronychia.	Whitlow.	Panaris.	Wurm, Panaritium.
Abcessus.	Abcess.	Abcès.	Abcess, Geschwür.
Ulcus.	Ulcer.	Ulcère.	Geschwür.
Pernio.	Chilblains.	Engelure.	Frostbeule.
Clavus.	Corn.		

[ORDER 9. DISEASES OF THE EYE.]

[Dysopia.]	[Difficulty of vision.]	—	—
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[ORDER 10. DISEASES OF THE EAR.]

[Dysœcia.]	[Difficulty of hearing.]	—	—
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[ORDER 11. DISEASES OF THE CONNECTIVE TISSUE.]

CLASS IV.—Developmental Diseases. *Metamorphici.***ORDER 1. DEVELOPMENTAL DISEASES OF CHILDREN—*Paidici.***

Natus Mortuus.	Stillborn.	Mort né.	Todgeboren.
Premature natus.	Premature birth.	Accouchement prema- ture.	Unzeitiggeboren.
Atelectasis Pulmonum.	—	Faiblesse.	Lungen-atelektasie.
Cyanosis.	Cyanosis.	Cyanose.	Cyanose.
Spina bifida.	—	Spina bifida.	Spina bifida.
Anus imperforatus.	Imperforate anus.	Imperforation de l'anus.	Atresia Ani.
Fatuitas.	Idiocy.	Idiotisme.	Idiotismus.
Mutitas.	Congenital Deaf- Dumbness.	Sourd-mutité.	Taubstummheit.
Dentitio.	Teething.	Dentition.	Zahnung.
[Battarismus.]	[Stammering.]		

ORDER 2. DEVELOPMENTAL DISEASES OF WOMEN—*Gyniaci.*

Chlorosis.	Chlorosis.	Chlorose.	Bleichsucht.
Partus, Abortus.	Childbirth, Miscarriage, Suites des couches. Abortion.		Kindbett, Fehlgeburt.
Paramenia.	—	Amenorrhée.	Unregelmässigkeit, oder Fehlen des Monats-flusses.
(Including amenorrhœa, leucorrhœa.)			
Climacteria.	Turn of Life.	Temps critique.	—

ORDER 3. DEVELOPMENTAL DISEASES OF OLD PEOPLE—*Geratici.*

Senectus.	Old age.	Sénilité.	Altersschwäche.
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ORDER 4. DISEASES OF NUTRITION—*Trophici.*

Atrophia, asthenia.	Atrophy, Debility (in- cludes premature old age).		Atrophia.
[Hypertrophia.]	[Hypertrophy.]	[Hypertrophie.]	[Hypertrophie.]
[Degeneratio.]	[Degeneration.]	—	—
—	a. (Fatty degeneration.)	—	—
—	b. (Mineral degeneration.)	—	—
—	c. (Pigmental degeneration.)	—	—
—	d. (Amyloid degeneration.)	—	—

CLASS V.—Lesions from Violence tending to Sudden Death.
Thanatici.

ORDER 1. ACCIDENT.

LATIN NAMES.	ENGLISH NAMES.	FRENCH NAMES.	GERMAN NAMES.
Ambustio.	Burn, Scald.	Brûlûre.	Feuer, Verbrennung mit heissen Flüssigkeiten.
Explosio.	Explosion of gun-powder, &c.	Explosion de —	Explosion von Pulver, &c.
Gelatio.	Frostbite.	Congélation.	Erfrierung.
Ictus fulminis.	Lightning.	Foudroyé.	Blitzschlag.
Insolatio.	Sunstroke, or Heat Apoplexy.	Coup de soleil.	Sonnenstich.
Submersio.	Drowning.	Submersion.	Ertrinken.
Suspendium.	Hanging.	Suspension.	Erhängen.
Suffocatio.	Suffocation.	Suffocation.	Erstickung.
Luxatura.	Dislocation.	Luxation.	Verrenkung.
Subluxatio.	Sprain.	Subluxation.	Verstauchung.
Fractura —	Fracture of —	Fracture de —	Bruch von —
Contusio —	Contusion of —	Contusion de —	Contusion von —
Concussio —	Concussion of —	Commotion de —	Erschütterung von —
Vulnus Sclopetarium—	Gunshot wound.	Plaie d'arme à feu.	Schusswunden.
Vulnus incisum.	Cut, Stab, &c.	Coupure, Piqure.	Schnittwunden.
Morsus Serpentis.	Snake bite.	Morsure de serpent.	Schlangenbiss.
Venenatio.	Poisoning.	Empoisonnement.	Gift.
Privatio.	Privation.	Indigence.	Armuth.
Vesiculæ pedis.	Footsore.		
[Amputatio.]	[Amputation.]	—	—
[Ablatio.]	[Extirpation.]	[Extirpation.]	—
[Excisio.]	[Excision.]	[Entaille.]	—

ORDER 2. BATTLE.
ORDER 3. HOMICIDE.
ORDER 4. SUICIDE. } The diseases or causes of death are the same as in ORDER 1.

ORDER 5. EXECUTION.—Mode of execution to be stated.

ORDER 6.* PUNISHMENT.

* My friend and colleague, Mr. Longmore, Professor of Military Surgery, has kindly drawn up the following statement relative to the practical working of this Nosology, as applied to the wants of the Military Medical Service:—"One of the first defects to be noticed is, that the List of Diseases named is chiefly applicable to returns explanatory of the mortality which occurs in a population. All the causes which lead to death are in this nomenclature, but not the causes of simple infirmity, or disability for particular pursuits. Soldiers are admitted into hospital and placed under observation, and, if necessary, treatment, for a variety of infirmities, for which admission would not be granted into a civil hospital. Hence the unsuitableness of the classification, as it exists, for a military hospital, the returns of which exhibit causes of death in comparatively few instances, while they have to show the causes of unfitness for military service from physical defect or infirmity in large numbers. A classified nomenclature, to be suitable for the purposes of an *invaliding* military hospital, should not only include the diseases which may prove causes of death, but also all those disqualifying physical imperfections and infirmities which prevent men from properly performing the duties of military service. A list of the Diseases Wounds, and Infirmities of Invalids, classified in accordance with the five

It will not be necessary to describe all the diseases enumerated in this classification; but those diseases will be described at length which mainly influence the health of the people, or which contribute to maintain or to increase the causes of death.

classes of the authorized Statistical Nosology, has been prepared for the Military Medical Service, and is to be found in the *Medical Regulations*, p. 141 (Form D). A return, according to this Form, is sent in annually by medical officers in charge of corps. (See *Instructions, Medical Regulations*, p. 116.) If this list of Causes of Invaliding were translated into Latinized names, in the same way as the names of diseases in the authorized Statistical Nosological List, the two lists together would include headings under which all the patients who pass through the General Invaliding Hospital of the army might easily and correctly be placed.

"In the Invaliding List, at the end of each Order of Disease, Wound, and Infirmary, appears the general designation 'Other Diseases.' Such an addition might also be advantageously made at the end of each order in the general Statistical Nosological List; but the exceptional cases so entered must be fully explained.

"Moreover, in the authorized Classified List of Diseases itself, difficulties frequently arise of another nature, attributable apparently to defects in the Nomenclature, or Nosological arrangement. The classification is, however, as a whole, such an immense improvement over the unscientific classification previously in use, that one is loath to call attention to these minor defects, more especially as it is understood that they are under examination, for purposes of revision, elsewhere. I will allude only to one or two of the difficulties which have been noticed in the Surgical Division of the Invalid Hospital at Fort Pitt.

"*First.* Diseases of the Eyes. In the Classified List these appear in Class I, Order 1, as '*Ophthalmia*,' or in Class III., Order 1, as '*Cæcitas*.' But many diseases of Eyes occur which cannot be rightly placed under either of these:—Affections of the cornea, sclerotic, iris, choroid, and retina; as well as defects of accommodation, such as myopia, hypermetropia, and amblyopia, with or without oscillating globes, strabismus, nystagmus, and also cataract. Close by '*Cæcitas*,' the Latin term for Blindness, we have applied to Diseases of the Organ of Hearing, '*Dysecaca*,' the Greek term for 'Difficulty of hearing,' or 'Imperfect hearing.' Were the corresponding Greek term '*Dysopia*,' or imperfect vision, employed in place of '*Cæcitas*,' it could either under it, or '*Ophthalmia* (for cases of *Zymotic* origin), include every case of Eye disease, leaving to minor returns to specify the particular nature of the inflammation, the structures involved, or the source of defective power, whatever it might be in each case.

"*Second.* An Eleventh Order, as well as a Ninth and Tenth Order of Class III.—*Local Diseases*—appears to be a desideratum, viz., for Diseases of the Connective Tissue. It is now impossible to find a correct place for tumors confined to this structure and other connective tissue affections.

"*Third.* Another order seems necessary in Class V.—'*Thanatici*'—for such *Privations of portions of the body* as are not the result of accident (Order 1), or of either of the subsequent orders—for such as are the result of surgical interference. It is a difficulty to know where to place '*Amputatio*,' '*Extirpatio testis*,' '*Resectio*,' &c.—e. g., the Order *Tychici*, by its name, should only include '*Fortuitous lesions*,' as in the Seventh Class of Good's Nosology, and these surgical operations are manifestly not capable of being included in any of the other orders of Class V., when they are performed for the removal of diseased conditions.

"In Class III., Order 7, for inflammation of bone, appears the name '*Ostitis*,' and this includes '*Periostitis*.' The latter is so distinct in its nature from true *Ostitis*, as shown in many cases, and both *Ostitis* and *Periostitis*, again, from '*Endostitis*,' or inflammation of the medullary tissue of bones—so frequent after gunshot injuries—that they should not all be included in one term. '*Endostitis*,' '*Ostitis*,' and '*Periostitis*,' are names which are all three required." Other deficiencies might be pointed out, did space permit.

THE SCIENCE AND PRACTICE OF MEDICINE.

PART III.

THE NATURE OF DISEASES—SPECIAL PATHOLOGY AND THERAPEUTICS.

It is the object of this part to treat of diseases in groups or classes, which possess certain characters or types common to the diseases composing each group; to describe, *Firstly*, The common properties or characters peculiar to the respective classes mentioned in the previous part on systematic medicine; to describe, *Secondly*, The several orders into which these classes of diseases may be subdivided; and, *Thirdly*, To describe in detail the several diseases individually, their *general nature and causes; symptoms, course, and complications; diagnosis, prognosis, and treatment.*

CLASS I.

ZYMOTIC DISEASES.

CHAPTER I.

GENERAL REMARKS ON THE PATHOLOGY OF ZYMOTIC DISEASES.

THIS class comprises diseases which have been observed to be *epidemic, endemic, and contagious*, and includes *specific fevers, small-pox, plague, influenza, cholera*, and such other diseases as possess the peculiar character in common of suddenly attacking great numbers of people, at intervals, in unfavourable sanitary

conditions. In the language of Dr. Farr, the "diseases of this class distinguish one country from another,—one year from another; they have formed epochs in chronology; and, as Niebuhr has shown, have influenced not only the fall of cities, such as Athens and Florence, but of empires; they decimate armies, disable fleets; they take the lives of criminals that justice has not condemned; they redouble the dangers of crowded hospitals; they infest the habitations of the poor, and strike the artizan in his strength down from comfort into helpless poverty; they carry away the infant from the mother's breast, and the old man at the end of life; but, their direst eruptions are excessively fatal to men in the prime and vigour of age. They are emphatically the *morbi populares*."

The name *Zymotic* (first suggested by Dr. William Farr to designate the class) is not to be understood as implying the hypothesis that these diseases are fermentations, which the derivation of the term would lead one to believe. It has become extensively used of late as applied to the diseases whose characters as a class are already indicated, and for which some convenient term is required. The class, then, to which the term ZYMOTIC has been applied is intended to comprehend all the principal diseases which have prevailed as *epidemics*, or *endemics*, all those which are due to *paludal* or *animal malaria*; and those due to *specific disease poisons*, capable of propagation from one human being to another, and *communicable either by direct contact*, or indirectly through various channels of human intercourse, contaminating drinking-water or infecting the air, *or by animals in a state of disease*. The class also comprehends the diseases that result from the *scarcity and the deterioration of the necessary kinds of food*, or from the generation, propagation, or existence of *parasitic animals*. The diseases of this class are thus conveniently arranged into four orders or groups, of which *continued fevers*, *syphilis*, *scurvy*, *worms*, are the common names typical of diseases in the respective groups.

In the greater number of the diseases of this class the blood is more or less changed, and by some is presumed to be the primary seat of diseases which result from specific poisons, of organic origin, either derived from without or generated within the body. These specific poisons tend to produce in the blood an excess of those decomposing organic compounds which

physiology teaches us are always present in the circulating current.

The Physiological Modes in which Poisons act Illustrate by Analogy the Zymotic Diseases.—If the reader will now consider the following statements as to the modes in which poisons act physiologically, he will be prepared to appreciate the effects of those conditions which, like poisons, induce diseases of the class termed Zymotic. The actions of poisons are subject to certain general laws,—the most important of which are, *first*, that they have all certain definite and specific actions; *second*, that they all lie latent in the system a certain but varying period of time before those actions are set up; and *third*, that the phenomena resulting from their action vary, in some degree, according to the dose and to the receptivity of the patient. These laws are common to all poisons, but there are also many others which are peculiar to individual poisons or classes of poisons, and it may be necessary to notice a few of them.

The *first* law, or that of the definite and specific actions of poisons, cannot be doubted; for if it be supposed that agents acting on the human body do not produce their effects according to certain definite laws, we can neither determine the seat or the course of any disease, nor direct nor judge of the operation of remedies. No one, for instance, has seen castor oil produce tetanus, or colchicum intoxicate the brain, or opium inflame the spleen. The physician perfectly well knows that the first of these substances acts on the intestines, the second on the ligaments, and the third on the nervous system generally. The action of poisons, therefore, is not accidental, but determined by certain definite laws.

The action of poisons, though definite, is variously limited. Some poisons, for instance, act on one membrane, or on one organ, or on one system of organs; while other poisons extend their action over two or more membranes, or organs, or systems of organs, or even over the whole animal frame. We have examples in aloes and jalap, of substances that act upon one membrane only, namely, the mucous membrane of the alimentary canal. In digitalis we have an instance of a medicine that principally acts on one organ, namely, the heart, greatly reducing or even stopping its action; while strychnine is an example of a medicine acting on one system of organs, namely, the parts supplied by the

spinal cord, producing powerful and sometimes fatal tetanic action of every voluntary muscle in the body.

It is seldom, however, that the action of poisons is limited to one membrane, or organ, or system of organs. The greater number of these noxious agents more usually act on two or more membranes, or organs, or systems of organs. Elaterium, for instance, acts on the mucous membrane of the intestinal canal and on the kidneys. Tobacco nauseates the stomach, intoxicates the brain, and affects the action of the heart. Antimony has an equally extensive range; it induces cutaneous perspiration, acts cathartically and emetically, and in large doses appears to cause gangrene of the lungs. Alcohol and opium are examples of substances acting still more generally, affecting not only the action or secretion of every organ or tissue of the body, but even in some instances altering their structure. Thus, alcohol in its most limited action has been shown to cause structural disease of the liver, of the stomach, and of the coats of the arteries, while opium tends to produce apoplexy and structural disorganization of the brain and its membranes. From the circumstance of these two substances acting, not only generally but locally, on a given number of tissues, they resemble in their effects those of many morbid poisons, as that of typhus fever, of scarlet fever, of the small-pox, or of syphilis.

The *second* important law of poisons is, that they lie latent in the system for a period of time which varies in different individuals, before they set up their specific actions. Rhubarb, for instance, produces no immediate result, but lies dormant in the system six or eight hours before its action is sensible on the bowels; opium, in the usual dose, is generally thirty minutes before it subdues the brain to its influence. The convulsions from strychnine do not follow till twenty minutes after its administration, and perhaps every substance, except hydrocyanic acid, has a greater or less sensible period of latency.

When a medicine, however, acts on more parts than one, a considerable space of time may elapse after it has affected one organ before it affects another: thus digitalis frequently occasions emesis before it acts on the heart, and the action of mercury on the bowels is frequently sensible for many weeks before the gums and salivary glands are affected. The doctrine of the latency

of poisons is indeed so generally admitted, that the actual period has been a point on which the condemnation or acquittal of a prisoner tried for murder has turned in our courts of justice, when certain poisons have been supposed to have been given.

The *third* great law of poisons is, that their effects are modified by the dose, the temperament, and the existing state of the constitution, mentally and bodily, of the recipient. The effect of dose in modifying the pathological phenomena of disease may be exemplified in the actions of oxalic acid and of arsenic. The specific action of oxalic acid is to inflame the mucous membrane of the stomach; but to insure this effect the dose must be limited so that this poison may lie in the system many hours. On the contrary, if the dose be excessive and rapidly absorbed, the poison so disorders all the functions of the three great nervous centres that life is destroyed in a few minutes. Arsenic, likewise, is a poison which inflames and ulcerates the mucous membrane of the alimentary canal, but it requires some hours to set up its specific actions; for, when the dose is large, it, in like manner, destroys by general irritation, and before traces of morbid change of structure can be appreciated after death. It follows, from this law, that the larger the dose, or the greater the intensity of the poison, the more rapid its action, and the less the probability of finding any trace of specific lesion induced by it.

In studying the effects of dose on the constitution, we find some poisons are absorbed and are *cumulative*, while others are not absorbed into the system; or they are so rapidly removed that no cumulative effect is produced. Thus, in persons predisposed to the effects of digitalis, a dose so small as to produce no sensible effect whatever, will, if frequently repeated, at last destroy the heart's action. In cases, likewise, in which it is desirable to produce vomiting at the least expense to the constitution, the means employed are *cumulative*, namely, a repetition of small doses of ipecacuanha. This cumulative property of poisons, however, is by no means universal. There is no instance of jalap or of castor oil proving cumulative; and if a frequent repetition of either of them produces an increased effect, it is, perhaps, in consequence of the nervous papillæ with which they are brought in contact being more easily irritated by each application, and hence they induce

a more violent result. That the habitual ingestion of decomposing matter in the water used as drink, is capable of inducing conditions favourable to the development of Zymotic diseases, admits of no doubt. Cogent instances of this are to be found recorded in the bitter experience of epidemics of cholera.

Temperament is also a circumstance which greatly influences the action of poisons. There are a few persons—rare exceptions—altogether insensible to the action of mercury, so that no quantity will affect their gums, or increase the secretion of the salivary glands. There are others, in like manner, the action of whose heart no quantity of digitalis will control. On the contrary, there are some constitutions—and these not so rare—so morbidly susceptible of these remedies that it is scarcely possible to administer even a fractional dose of these drugs without giving rise to their specific effects.

Besides natural temperament, *habit*, which may be termed an artificial temperament, has a powerful influence in reconciling us to particular classes of poisons, and of making them even sources of enjoyment. Thus tobacco, alcohol, opium, are all substances which are productive, in the first instance, to many persons, of great discomfort, but by frequent repetition they cease to have any unpleasant effects, and their stimulus at length becomes a necessary indulgence. Still there are many poisons to which no repetition can habituate us. On the contrary, each repetition only the more debilitates the constitution, and renders it more susceptible of the action of the poison.

A peculiar existing state of the constitution has also a powerful influence on the action of poisons; and it would seem proved, with some exceptions, that these agents act with an intensity proportioned to the debilitated state of the patient. There is indeed no duty more imperative on the physician than that of adjusting the dose to the strength of the patient, and nothing is more common than to forbear administering a medicine because the patient's strength will not admit of it. As a general principle, therefore, medicines or poisons may be said to act with a power proportionate to the debility of the patient.

Still there are states of disease which render the constitution of the patient, though greatly debilitated, insusceptible to the action of even powerful remedies. Thus, in typhus fever, the patient

will often bear a considerable quantity of vinous stimuli without being affected by it. In tetanus, or hydrophobia, no quantity of opium will tranquillize the symptoms or procure sleep. Fallopius mentions a singular instance of the constitution being armed against the action of a poison. He states that in his day a criminal was given up to himself and other anatomists, to be put to death in any manner they might think proper. To this man, therefore, they administered two drachms of opium, but, labouring under a quartan ague, and the fit just coming on, the "opium was hindered of its effect." The man, therefore, having survived this dose, begged that he might take a similar quantity, earnestly entreating, if he escaped, that he might be pardoned. The same dose was repeated, but it was in the interval of the attacks, and the man died.

The experiments of Majendie may be referred to as affording many curious proofs of the state of the constitution in accelerating or retarding the actions of poisons. He has shown that if a poison be introduced into the system, of such potency as usually will destroy life in two minutes, on bleeding the animal the same result will follow in half a minute, or in one-fourth of the time; and this experiment has often been repeated. Majendie has also brought to light the curious fact, that if, after having poisoned the animal, and even after the poison has begun to act, we inject an aqueous fluid into its veins in such quantity as to cause an artificial plethora, as long as this artificial plethora can be maintained, the action of the poison is superseded. No sooner, however, does the plethora cease, from the general effusion of fluid into every cavity of the body, than the poison acts in the usual time, and with even perhaps more than its accustomed severity.

Mr. Hunter thought that no two poisons could *co-exist* in the same system together, or that, co-existing, they could not set up their specific actions at the same time. This hypothesis, however, is unquestionably erroneous; for we constantly see opium and digitalis, jalap and mercury, as well as many other combinations of medicines, producing their respective effects in the same system, and at the same time, by accelerating or retarding each other's actions. There is no truth better established in medicine, than that a combination of salts and senna produces a much more efficient and pleasant action than the administration of either

remedy separately; and opium is an agent possessing a modifying or controlling power over every organ or tissue, without which it would be impossible, on many occasions, to reconcile the system to the introduction of many necessary and essential remedies. Poisons, therefore, are capable of co-existing together, and of so influencing the system that they reciprocally accelerate or retard each other's actions. The co-existence of two or more specific diseases has been already noticed at page 131.

The general laws observable in the actions of medicinal substances are for the most part precisely similar to those which govern morbid poisons, or only differ in a few minor points; for these latter poisons have their specific actions and their periods of latency, while their phenomena are not less variable, although the conditions of their varied actions are not yet clearly determined.

Specific Action of Poisons which Produce Zymotic Diseases.—The specific actions of poisons which produce the Zymotici are distinctly proved by the fact, that we are enabled to determine, within certain limits, the course, symptoms, and pathological phenomena which result from the presence of any given morbid poison. No man, for instance, can confound the phenomena of *small-pox* with those of *intermittent fever*, or those of *intermittent fever* with *syphilis*, or those of *syphilis* with *cholera*; each of these poisons has its separate and peculiar origin, course, development, and mode of propagation, and consequently their actions are so far definite and specific.

The actions of morbid poisons also, like those of medicinal substances, are variously limited, some affecting only one membrane or organ, or system of organs, while others involve two or more membranes or organs, or systems of organs. Thus, *tinea* is an example of a noxious germ acting on one tissue of the body, and even then partially. In some parts of the world, for instance, in Switzerland, in the Brazils, in the Andes, and some of the North-west provinces of India, a poison exists, associated with limestone and sometimes magnesian geological formation, whose action is limited to the undue ossification and thickening of the base of the cranium, tending to diminish the size of the foramina for the blood-vessels, and so leading to cretinism, and to growth of the thyroid gland in goitre. (KÖLLIKER and REVIEWER in *B. and F. Med.-Ch. Rev.*, 1861, p. 43.) Mr. Ceely,

mentioning the fact that at Aylesbury, where goitre prevails, the soil is mainly limestone, incidentally states that solid aggregations of calcareous particles are also found in the thyroid gland. The contagion of *whooping-cough* and the virus of *hydrophobia* affect all the organs supplied by the eighth pair, or pneumogastric system. Instances of morbid poisons acting on several membranes or organs, or system of organs, are still more common, and form the great body of this class of disease. The poison of *measles*, for instance, expresses itself no less on the mucous membrane of the eyes, nose, fauces, and perhaps on the mucous membranes generally, than on the skin; that of *scarlatina* not only on the mucous membrane of the fauces, and on the skin and the kidneys, but also on the serous membranes of the joints and of the abdomen. The *paludal* and the *syphilitic poisons* have a still more extensive range, hardly any organ or tissue of the body being exempt from its destructive ravages.

Morbid poisons also, like other poisons, have their periods of latency; and, generally speaking, a much longer time elapses before their specific actions come into operation than takes place with medicinal substances. The virus of the *natural small-pox* lies dormant from sixteen to twenty days before it produces any constitutional disturbance; and a still further period elapses, of three or four days, before the specific eruption appears on the skin. The poison of *scarlatina* lies latent from seven to ten days after exposure to the contagion; that of the *measles* from ten to fourteen; while the poison of *paludal fever* has been said to lie dormant for a twelvemonth, and that of *hydrophobia* for a still longer time. These are examples of periods of latency far beyond anything that has been observed in the action of medicinal substances; and *syphilis*, in its remote effects upon the organs and the constitution generally, is still more remarkable.

When morbid poisons act on more tissues or organs than one their actions are sometimes simultaneous, but more commonly they are consecutive, and frequently long intervals of time elapse between each successive attack. Thus, the poison of *typhus* and *enteric fever* may attack the lungs, the membranes of the brain, and the mucous membrane of the alimentary canal, and all these may be attacked contemporaneously; but it is more common that their attacks take place consecutively, or first on the alimentary canal, then on the brain, and lastly on the lungs, several days

elapsing between each successive attack. In *syphilis* the poison acts on the part to which it is first applied—as the skin, throat, bones, and ligaments; and cases have been met with in which the throat, the skin, and the bones have been affected at the same time, but subsequently to the infection from the primary sore. It is more common, however, for them to occur *seriatim*, and at very remote periods from the primary affection, so that many years frequently elapse before the poison exhausts itself. In *scarlatina*, also, the peritoneum is not affected till many days after the eruption of the skin and the ulceration of the throat have altogether disappeared.

It occasionally happens that morbid poisons which usually act on a plurality of membranes, exhaust themselves on one or more without affecting the whole series. In the disease termed *scarlatina simplex* the poison sometimes exhausts itself entirely on the skin without affecting either the mucous or serous membranes of the body. The *rubeola sine catarrho* is a similar example of the poison exhausting itself on the same tissue, the skin. In *intermittent fever*, when the dose of the poison is limited, and the disease properly treated, it is seldom that any organ or tissue is involved; yet, left to run its course, scarcely any organ or tissue would escape being affected and its function impaired.

Sometimes, when the morbid poison acts on many membranes, the usual order of attack is inverted. It is the general law of *syphilis*, that the bones are the last that suffer in the order of the secondary symptoms, but sometimes they are the first to be affected. In *scarlet fever* the affection of the skin may precede that of the throat, or the reverse may take place.

It has been seen that the period of latency of medicinal substances being passed, and their actions set up, their effects vary in a considerable degree, according to the dose, temperament, or present state of the constitution of the patient. With respect to the dose of a morbid poison, we rarely possess any direct measure of its strength. The *paludal poison*, however, of tropical climates, to which *malarious fevers* are due, unquestionably greatly exceeds in intensity that of more temperate climates, and its effects are proportionally marked. Thus, in the West Indies, we have the severe remittent fevers, with hardly a trace of organic lesion after death, so rapid is their course; in Holland we have a paludal fever of less severity, but

followed by enlarged livers or spleens, or by dropsy; while, in this country, the same fever is comparatively mild, and, if properly treated, for the most part terminates without any visceral affection. With respect to the influence of temperament in modifying disease, *small-pox* offers very striking instances; for different persons inoculated or poisoned from the same source have suffered in every varying degree from this formidable malady—from the *horn*, the *distinct*, the *confluent*, and the *bloody small-pox*; while, in the worst cases, children have died in the primary fever, and before the specific action on the skin had been induced. It may, therefore, be laid down as a general law, that the more intense the dose of the morbid poison, the more severe the form and rapid the course of disease; and also that fewer traces of organic alteration will be found after death than when the poison, or the disorder it produces, has been of a milder character and the course of the disease more prolonged. Thus, enlarged livers, disorganized spleens, and dropsy, marked every case that died of the Walcheren fever; while in the West Indian and African fevers, though resulting from the same poison, scarcely a trace of disease was to be found.

The existing state of the constitution also influences the event. Thus, persons of a good constitution, but ignorant of their danger, are often seen to pass through a mild form of typhus fever, while the nurses and others contaminated by the same poison, but more alive to their critical state, have sunk in a short time. A presentiment of death is a very unfavourable circumstance in the progress of *remittent* fever, especially in tropical climates. A soldier will say, "You have been very kind to me, sir; but this time I shall not get over it." There may be no appearance of absolute or immediate danger at the time—yet the man generally dies (SIR RANALD MARTIN). As a general principle, therefore, it may be stated, that morbid poisons act with an intensity proportioned to the enfeebled or depressed state of the constitution; but this law is not universal. Want of a sufficient amount of food is most powerful among the conditions which bring about Zymotic diseases, and most constant in operation. It is a popular belief that the lowering of all the vital forces by deficiency of food constitutes the particular condition which renders a starved population so peculiarly open to the invasion of Zymotic diseases; but it is also a curious phenomenon of starvation, that a state of

general putrescence supervenes during life, as if the want of material for the generation of new tissue were an obstacle to the deportation of that which has become effete (CARPENTER). The hardy mountaineer is a surer victim, whether he visits the low countries of the tropics or the marshes of a more temperate climate, than the feebler native of those countries. The immunity the latter enjoys is probably owing to his habit of living in the noxious atmosphere; for let him remove to a more healthy climate, and then return to those regions of pestilence, and he will be found as susceptible of the poison as the hardier stranger.

Another law of morbid poisons is, that two or more may *co-exist* in the same system. Of this fact numerous examples have been mentioned at page 131. In these cases the respective diseases sometimes appear simultaneously, and each runs its course, more or less modified by the presence of the other. The more usual law of febrile poisons perhaps is, that when two co-exist, one lies latent while the other runs its course, or they interrupt each other's progress, the active one becoming latent while the latent one becomes active, and occasionally they modify each other's actions. A case of intermittent fever may suddenly subside, and the small-pox appear in its stead. The small-pox having run its course, and the patient being recovered from that disorder, the intermittent fever may return. A child, having been exposed to the infection of the small-pox, was vaccinated; in a few days, however, the small-pox appeared, and ran a very mild and modified course. When the small-pox had entirely subsided, some action was seen in the punctured part of the vaccinated arm, and the cow-pox vesicle formed, but not till three or four weeks after the time it usually appears, and then exceedingly small. (See MURCHISON, l. c.)

Peculiarities in the action of Poisons which induce Zymotic Diseases.

—The principal points in which the effects of poisons which induce Zymotic diseases, agree with those of poisons generally, having been stated, it will now be necessary to state those circumstances in which they principally differ. Many medicinal poisons have the property of accumulating in the system, and acting with an intensity proportioned, not to the last dose, but to the aggregate of the whole quantity that has been administered. Thus the last few minims of digitalis may stop the action of the heart, or the last few grains of mercury salivate the patient, or

the last minute dose of strychnine become fatal. There is, however, no well authenticated fact which can be arranged under this law in the whole circle of morbid poisons, except, perhaps, the cumulative and persistent pernicious action of paludial malaria. The actual quantity required to establish disease, according to the experiments of Dr. Fordyce, is probably extremely small. That physician, in the hopes of mitigating the small-pox, inoculated with virus greatly diluted; and although the disease was not always produced, yet when produced, it assumed every form, character, and degree of severity that small-pox has ever been known to assume.

The puerperal female is not only highly susceptible of poisons of the Zymotic kind, but is proved to favour their further development; and forms of puerperal fever seem capable of generation by *materies morbi* of a kind other than that which might be considered peculiar to it. It is a well-known fact, unhappily not of rare occurrence, that a medical practitioner or a nurse goes from a case of puerperal fever to attend on other cases of labour, and the chances are that these will be attacked with the disease. Further, the practitioner or nurse may go to cases of labour from attendance on a case of scarlatina, typhus, erysipelas, or small-pox, and his parturient patients become the victims of puerperal fever. Their system is peculiarly receptive of the Zymotic poisons.

In the Vienna Lying-in Hospital it is on record that a mortality of 400 to 500 in an average of 3,000 deliveries per annum appeared traceable to the introduction of cadaveric matters, through the uncleanness of the attending students; these matters being especially potent when derived from the bodies of those who have died from the adynamic forms of Zymotic disease. Students of practical midwifery should bear in mind this fact. They ought not to attend cases of labour while they are also engaged with practical anatomy in the dissecting room.

Another peculiar law of morbid poisons, and one wholly unknown in medicinal substances, is the faculty which the human body possesses of generating to an immense extent a poison of the same nature as that by which the disease was originally produced. A quantity of small-pox matter not so big as a pin's head will produce many thousand pustules, each containing fifty times as much pestilent matter as was originally inserted; and, moreover,

the blood and all the secretions of the body are supposed to be also equally infected with the matter of the pustules. The miasmata secreted by one child labouring under whooping-cough are sufficient to infect a whole city.

There is still perhaps a more remarkable law of morbid poisons, which is, that many of them possess the extraordinary property of exhausting the constitution of all susceptibility to a second action of the same poison. This is the case with scarlatina, measles, typhus fever, the small-pox, the whooping-cough, and indeed with a considerable number of others. Still it would seem that a temporary protective influence is imparted by most morbid poisons, for it is certain that few persons suffer a second attack of the same specific epidemic disease; and, consequently, it follows that the previous action of the poison must for a time impair the susceptibility of the constitution to its attacks. This beneficent law is of great importance in social life; it enables those that have recovered to attend on those that are sick, and allows a mother fearlessly to nurse her child in a dangerous and contagious distemper she has herself passed through, if such an inducement is ever necessary to strengthen the moral courage of a mother.

It only remains to mention one other law, which is but little shared by poisons of the vegetable or mineral kingdoms. It is well known that the actions of vegetable or mineral poisons are not influenced by the climate in which they are administered. Climate, however, has the property of greatly modifying the intensity of morbid poisons. The severe forms of typhus fever, so common in the northern latitudes, are hardly known in the more southern; and the existence of true typhus seems as yet unauthenticated in Asia, Africa, or the tropical parts of America. Cholera has been infinitely more fatal in Europe and in America than in the country which gave it origin; but besides influencing the intensity of the disease, climate or season, or both, greatly modify the specific nature of morbid poisons. In one paludal district the liver will be inflamed and the spleen healthy, and in another the liver will be unaffected but the spleen disorganized. In both cases the generic character of the disease remains the same, but its specific character varies. It will have been seen, that such variety of pathological phenomena may be due to peculiarity of constitution or *idiosyncrasy*, and that nothing can be more different than *the*

distinct, the *confluent*, and the *horn small-pox* from each other; and yet all these different varieties may exist in different persons inoculated with the same poison. The character of the vaccine pustule is equally various; so that the particular vaccine pustule which certainly insures exemption from the small-pox has not yet been satisfactorily determined; neither have pathologists determined with absolute certainty the primary forms of the infecting syphilitic sore. It is important, therefore, to remember, in the study of morbid poisons, that absolute uniformity of pathological phenomena is not to be expected in different persons and in different seasons. There is a limit, however, within which their variations oscillate, and within which nature has bounded her deviations.

The laws of poisons are not more important than their *modus operandi*; and this part of the subject has been deeply investigated by modern physiologists, and deserves some consideration. The great and striking alterations which often take place in the blood, led from a very remote period to the doctrine of humoralism, or, that a morbid state of the fluids was the great and primary cause of disease. On the contrary, when anatomy began to be cultivated, and nerves traced into every organ and tissue, it was supposed that disordered actions of these prime agents of motion, and of the great phenomena of animal life, were the great causes of disease; the morbid state of the fluids being secondary. Fontana determined to prove this latter theory, and found, to his surprise, on laying bare the sciatic nerve in a great number of rabbits, that neither the venom of the viper, nor the hydrocyanic acid, when applied to it, produced the phenomena of poisoning, and that no other consequence resulted beyond what would have been produced by a similar mechanical injury. Having thus shown that the phenomena of poisoning do not result from the application of the deleterious agent to the trunk of the nerve or to the *solids*, he determined to ascertain whether they followed after absorption, and consequent contamination of the *fluids*. He therefore injected the venom of the viper, hydrocyanic acid, and other poisonous substances, directly into the veins of different animals; and he found that although the nerves of a part may be steeped in these poisons with impunity, yet no sooner did the substance enter the veins than the animal, after uttering a few horrible shrieks, struggled and almost

instantly died, and thus demonstrated a morbid state of the fluids, as well as the existence of a tissue of extreme sensibility, with which the poison being brought into contact, accounted for the death of the animal. Fontana pursued this subject one step farther, and showed, if poisons acted by absorption, that this absorption was in many instances extremely rapid. He submitted a number of pigeons to be bitten in the leg by a viper. He then chopped the wounded limb off at different intervals after the introduction of the venom, and found, as the result of an extensive series of experiments on several dozens of pigeons, that none recovered when the poisoned leg was removed at a later period than twenty-five seconds, though the phenomena of poisoning did not occur till several minutes later.

The experiments of Fontana had shown (supposing a poison to be introduced into the veins), that all the phenomena of poisoning were accounted for; but still it might be said, that to prove the fact of absorption something was wanting in strict demonstration. For the further prosecution of this subject we are indebted to Segalas, who showed, that if the arteries and veins of the mesentery of a dog be tied, a quick acting poison would lie in harmless contact with the corresponding portion of the intestine for many hours; but no sooner were these ligatures removed than poisoning took place in a few minutes. Majendie even has carried this proof, of the veins absorbing, still farther. He amputated the leg of a dog, having first introduced a portion of quill into the femoral artery and vein, in such a manner that, on dividing these vessels, the leg hung connected with the trunk solely by means of the quill, all continuity by means of the solids being cut off. The poison was now introduced into the paw, and in four minutes the animal was under its influence.

By these experiments, it is apprehended that Fontana, Segalas, and Majendie have completely demonstrated the absorption of poisons by the veins, and consequently of their circulating with the blood; and that no doubt may remain on the subject, modern chemistry has demonstrated the actual presence of many medicinal substances either in the blood itself, or in the secretions formed from it. Thus, after the free use of soda, large quantities of uncombined alkali have been found in the serum. Alcohol has been obtained by distillation from the blood; while iodine, rhubarb, the nitrate of potash, and a large number of other substances

taken into the stomach have been found in the urine. It follows, then, that poisons are absorbed and mingled with the blood, and are conveyed directly to the parts on which they act, passing with impunity over others for which they have no affinity.

The fact of morbid poisons in like manner being absorbed, and mingling with the blood, has been shown by many continental writers; but perhaps the experiment made by Professor Coleman is the most satisfactory. "I have produced the disease (the glanders) by first removing the healthy blood from an ass, until the animal was nearly exhausted, and then transfusing from a glandered horse blood from the carotid artery into the jugular vein. The glanders in the ass was rapid in its progress, violent in degree, and from this animal I afterwards produced both glanders and farcy." Both scarlatina, measles, and syphilis, have now also been produced by inoculation from the blood of patients labouring under these diseases.

The circumstance of the presence of a poison in the blood is supposed by Andral to produce, besides its toxic states, certain alterations in its physical condition. Thus he conceives a specific cause has a tendency to destroy or reduce the quantity of fibrine in the blood, which he has found in some instances to be only one part in a thousand. Hence he adds, whatever may be the nature of the pyrexia, the blood always exhibits the following characters whether it be taken from a vein or collected from the heart and arteries after death,—namely, that the serum and clot are incompletely separated the one from the other, so that the clot is consequently large, and often appears to fill almost entirely the bleeding-basin. Its edges also are never raised, and its consistence is inconsiderable, so that it is easily torn, broken down, and reduced to a state of diffuence; in this state it becomes grumous, and discolours the serum. It is also remarkable for the absence of all buff, which is rarely met with in typhus, in measles, in scarlatina, or in small-pox, unless there has been some inflammatory complication; and even when it does exist, as in confluent small-pox, with large collections of pus, the buff is soft and gelatinous, and, by expression of the serum, is easily reduced to a thin pellicle. This defect of fibrine he conceives to be the cause of the great tendency to hæmorrhage, and to that stasis or congestion so remarkable in typhus fever, scarlatina, and other diseases dependent on morbid poisons.

The facts and arguments which have been adduced, have, it is apprehended, distinctly proved that morbid poisons act in all instances not capriciously, but according to certain definite and specific laws, modified by the influence of climate, temperament, or the magnitude of the dose; also, that they mingle with the blood, with which they continue in latent combination a certain but varying period of time; and likewise that many of them are capable of co-existing together in the same system. Two other remarkable laws result from the study of morbid poisons,—namely, that these singular agents are not acted upon by medicinal substances as long as they continue latent: and again, that when they act on more tissues than one, the remedy which is an antidote to the action on one is often absolutely powerless when it affects another tissue; so that many different remedies are frequently necessary to combat the varying phenomena of the same disease. A knowledge of these laws is necessary for understanding this class of diseases, and it is hoped that by their application many of the difficulties which have hitherto obscured the doctrines of fever, of syphilis, of hydrophobia, and of many other diseases incident to this class of morbid poisons, may be removed, and that this portion of medical science may be placed on a surer foundation, if not on a permanent basis.

Deaths from Zymotic Diseases.—The average annual rate *per cent.* of mortality in Great Britain for the past seventeen years is represented by 2·245; *i. e.*, nearly 22 per 1,000, or 1 in 45 of the population. This statement is given, as a fact by which the student may compare the numerical statements which are made in estimating the fatal nature of individual diseases, or of diseases considered in classes.

With regard to diseases of the Zymotic class, it may be stated generally, that from 21 to 26 *per cent.* of the total number of deaths which take place in Great Britain during a year are due to diseases of this class. Generally speaking, also, they may be arranged in the order of their greatest fatality, as follows:—namely, cholera, typhus, and other forms of continued fever, scarlatina, whooping-cough, measles, croup, small-pox, dysentery, erysipelas. The other diseases of this class are less fatal; and it has been observed, that of late years, small-pox and influenza and typhus fever are less fatal than they used to be.

Under the class of Zymotic diseases the following orders are to be distinguished and described, namely,—

ORDER 1. Miasmatic Diseases—*Miasmatici*.

ORDER 2. Enthetic Diseases—*Enthetici*.

ORDER 3. Dietic Diseases—*Dietici*.

ORDER 4. Parasitic Diseases—*Parasitici*.

CHAPTER II.

PATHOLOGY OF THE Miasmatic Order of Zymotic Diseases.

THE diseases to be described under this order acknowledge at least three sources or modes of origin; while they are all mainly propagated, disseminated, communicated, or diffused through the agency of contaminated persons, food, water, or other agents, or through infected air. The poisons, miasms, gases, germs, active principles, or morbidic agents may be arranged under three classes, namely,—1st. Palludal malarious poison; 2nd. Animal malaria poison; 3rd. Specific disease poisons. The diseases they engender are attended by a febrile state which may assume various forms or types.

Palludal Malarious Poison.—This poison arises from marshy land in particular conditions, such as decomposition under the influence of partial moisture, and of heat above 60° Fahr. If the land is perfectly dry or perfectly flooded the poison is not generated. It is a material poison. It may be wafted along with the wind, and so induce fever at a distance from the place where the poison is generated. It may also be intercepted by a belt of trees. It appears to be most intense near the surface of the ground. The diseases usually attributed to this endemic source, and which were formerly so destructive, have almost disappeared from this country. The reason of this may fairly be ascribed to the improved drainage both of the towns and of the agricultural districts. The fact may be proved, did space permit; and the practical inference leads one to hope for still more immunity from diseases arising from this source, if the “proper authorities” direct further efforts in this direction. “Within the

last half-century land-draining and town-sewering have ripened into sciences. From rude beginnings, insignificant in extent and often injurious in their effects in the first instance, they have become of the first importance. Land has, in many instances, doubled in value; and town-sewering, with other social regulations, have not unfrequently prolonged human life from five to fifty per cent., as compared with previous rates in the same district." "Agues (and malarious cachexiæ) are reduced. Since 1840 an annual mortality in English towns of 44 in 1,000 has been reduced to 27; an annual mortality of 30 has been reduced to 20, and even as low as 15; and human life has now more value in England than in any other country in the world—a result entirely due to better sanitary arrangements." (Rawlinson, *Journal of Society of Arts*, March 21, 1862, vol. x., p. 276.)

The time indeed appears to have arrived when accurate sanitary statistics should not only be kept for all branches of the public service, but also by all corporations, municipalities, boards of commissioners, and parish vestries, for the population within their respective jurisdictions. Such statistics should be published at least once every year, as the natural history of the population. (*Sanitary Statistics, B., International Statistical Congress*. London, 1860. Second Section.)

Animal Malaria Poisons or Effluvia.—Animal effluvia arise from the decomposition of the exhalations, excrements, or excretions of individuals (whether of mankind or of the brute creation), of filthy habits, or when crowded in confined spaces. Such poisons appear to be more limited in the causation of disease than the paludal poisons just noticed. We know little about them except that they are developed in situations where numbers are crowded together, as in prisons, hospitals, besieged towns, camps, ships, and such-like places. Winter is known to be favourable to their development and deleterious influences. They are sedative or depressing in their actions, and while they lower the energies of the nervous system, they tend also to corrupt or poison the blood, surcharging it with decomposing organic compounds.

Ephemeral febrile states are produced, and such conditions of ill-health are thereby established, so that a certain proclivity to the more serious and specific communicable diseases seems to be entailed. Conditions of the constitutions are brought about by which a certain receptivity or disposition of the blood is pro-

duced, rendering it more liable to undergo those changes which it undoubtedly undergoes during the progress of the specific diseases about to be noticed. Thus we have a predisposition to certain diseases brought about, and especially to such specific febrile affections as *typhus fever*, *dysentery*, *cholera*, and the like. Dr. Carpenter (than whom we have not a better physiological authority), in an interesting paper on the *Predisposing Causes of Epidemics*, shows that the conditions which tend to bring about the specific miasmatic diseases of the Zymotic class are referable to three categories:—(1.) Conditions which may introduce into the system decomposing matter that has been generated in some external source. (2.) Conditions which occasion an increased production of decomposing matter in the system itself. (3.) Conditions which obstruct the elimination of the decomposing matter normally or excessively generated within the system, or abnormally introduced into it from without.

The decomposing matters generated in external sources may be enumerated as putrescent food, water contaminated by sewerage or other decomposing organic substances, and air charged with miasmatic emanations. The constant breathing of such putrescent effluvia may, by communicating a putrescent tendency to the blood, render it more prone to the changes by which specific poisons are multiplied. Ill-health and consequent receptivity for any specific disease poison are developed by the degeneration of the tissues within the body, such as occur in the puerperal state, after severe injuries, and as a consequence of excessive muscular exertion; and also by an insufficient supply of air, a high external temperature, and the ingestion of alcoholic drinks. Each and all of these causes tend to induce morbid conditions of the blood, a tendency to putrescence, and a condition of ill-health of the body.

Specific Disease Poisons.—The matter by which the specific miasmatic diseases are communicated and propagated is solely derived from the body of the similarly diseased human being; for there, during the course of the specific disease, is the soil in which the specific poison is bred to multiply and propagate its kind. It is not yet clearly established how far the bodies of animals may not be a soil for the propagation of diseases communicable to man. (See the Sections on Small-pox and Cow-pox.)

The diseases of the lower animals are not sufficiently studied by us. The diseases of plants are almost entirely neglected. Yet it is clear, that until all these have been studied, and some steps taken to generalize them, every conclusion in pathology, regarding the nature of the propagation and dissemination of specific miasmatic and even of parasitic, dietic, and enthetic diseases, must be the result of a limited experience from a limited field of observation. How do we know that the blights of plants, or the causes of them, are not communicable to animals and to man? We know how intimately related the diseases of man and animals are with famines and unwholesome food; and of famines with the diseases of vegetable and animal life, as much as with the destruction and loss of food.

Dr. Carter, of Bombay, has shown that there is in India a very singular, and although strictly endemic disease, yet a very prevalent one, which occurs in the hands and feet, especially the latter, and which it is probable is really of the nature of a "blight," in so far as it is owing to the implantation in the tissues of "sporules or germs," which in the progress of development commit irremediable ravages on the affected parts, leading ultimately to entire disorganization of the tissues. It is known as the "fungus disease of India," and is described by Dr. Carter in the *Transactions of the Medical and Physical Society of Bombay*, No. 6, new series for 1860.

On the relations between the diseases of man and animals, and especially in connection with food, the reader is referred to a series of papers by the author, in the *Medical Times and Gazette* for 1857.

Dr. William Budd, of Bristol, has also recently directed attention to the occurrence of malignant pustule *in England*, in a paper read at the great meeting of the British Medical Association in London, in August, 1862. He has shown that the disease has not been so uncommon in England as had been supposed—that it is common and very fatal to oxen and sheep in this country—that in man and in sheep the disease is identical—that it is communicable to man by direct inoculation, and also by eating the flesh of the animals affected—that it may be conveyed and disseminated by the bites of insects, such as gnats—and that the disease may be recommunicated from man to animals. (*Brit. Med. Journal*, January 24, 1863.)

There are some peculiar and characteristic features especially pertaining to the specific diseases of the Miasmatic order which require special notice as introductory to a description of the individual diseases:—First, *They may suddenly spring up in a locality—under unfavourable sanitary conditions.* Second, *They may rapidly spread at irregular intervals, so as to incapacitate or destroy great numbers of people.* These two marked and striking features are technically described as being due respectively to *Endemic* and *Epidemic influences*, the nature of which will be considered in the following chapter.*

CHAPTER III.

ON THE NATURE OF ENDEMIC, EPIDEMIC, AND PANDEMIC INFLUENCES.

Endemic Influences result from those conditions or agencies peculiar to a locality which favour the development of various miasmatic diseases, and may thus account for their sudden origin. Such diseases are then said to be *endemic*. These endemic influences, for the most part, are exerted by the geological properties of a district, and are traceable to the constitution and state of the soil, water, and air; to elevation above the level of the sea, vicinity of sea, rivers, or stagnant water, woods, and vegetation; variations of temperature, prevalent winds; in connection with avocations, modes of life, quality of food and quantity, as modified by moral agencies, such as indolence or activity; privation and comforts, filth or cleanliness of people; together with their habits of life and employments, ignorance or mental culture; and, lastly, their social, moral, religious, and political conditions. It may be shortly stated in illustration, that endemic influences become mainly active through the following conditions, namely:—
1st. That the specific poisons by which the communicable diseases,

* Deputy Inspector-General Dr. Lawson has recently called the attention of the profession to what he considers to be *oscillations* of influences over the whole world, determining febrile diseases. To such influences he gives the name of “Pandemic.” (*Transactions of Epidemiological Society* for 1862; also, *Statistical, Sanitary, and Medical Reports of the Army Medical Department* for 1861.)

such as small-pox or typhoid fever, propagate their kind are never totally in abeyance. 2nd. The specific communicable diseases are constantly extant somewhere, and only under conditions favourable to their dissemination do they spread or become epidemic. Although their germs, specific gases, active principles, or media of propagation and development may lie dormant or latent for a time, it is not to be inferred that they have ceased to exist. 3rd. The history of all the specific communicable diseases demonstrates the same alternations of slumber and activity; of wide-spread prevalence in one place, while neighbouring places may remain free; and finally, the same successive invasion of neighbouring places, such that the prevailing disease only begins to prevail in the new locality after it has already died out in the old. 4th. One element remains constant in the history of endemic influence, and that is *the specific morbid poison* which is the origin of each case. It is susceptible of transmission from place to place, and may gather strength as it proceeds, again to die out or become dormant, so that its track is with difficulty followed or traced out. 5th. In large cities such specific poisons are always more or less active, and their diseases always present; but in the country districts they only now and then occur. The occurrence of long intervals of rural exemption is not traceable to any feebleness of the poison to act; for, when the disease does become developed in these places, the ratio of persons or of animals attacked is incomparably greater than is ever seen in cities under like circumstances. (See Professor Acland's account of the fever in Great Horwood in 1857-58; and Dr. William Budd, of Clifton, regarding fever at North Tawton; and his most instructive little book *On the Propagation of Typhoid Fever*.) 6th. In large towns the sewers are constantly charged with the *materies morbi* of specific diseases always abounding in towns. In small villages and other places, where no sewers exist, the air only may be infected, or the water contaminated, by the direct or indirect importation of cases of specific disease or their equivalents—the poison itself—so that the organic impurities, the dung-heaps, the open soil which surrounds the dwellings of the patients, the cess-pools, and the privies common to several houses, gradually but eventually become impregnated with the specific poison of the disease. Thus the atmosphere of the village may become incomparably more virulent than the atmosphere of the sick-chamber

itself. Hence the rapid epidemic spread of the miasmatic diseases in the limited space of rural villages; and which gives rise to the popular error, that such diseases are invariably contagious in country places, and only rarely so, or by exception, in cities or large towns. 7th. All these specific diseases multiply their kind after similar modes of propagation. 8th. All of them establish a constant series of morbid changes and lesions, and always issue in the reproduction of its own specific germ, miasm, gas, morbid poison, or active principle by which it propagates its kind. Thus small-pox propagates small-pox; measles multiplies measles; scarlatina reproduces scarlatina; typhoid fever breeds typhoid fever; typhus, typhus; and so on. In the terse language of Dr. William Budd,—“What small-pox and measles were in the Arab in the days of Rhazes, they still are in the London Cockney of our own time. What they are in the London Cockney, they are in the wild Indian of the North American prairie, and in the Negro of the Gold Coast. To all the other specific communicable diseases, as far as our records go, the same remark applies. In races the most diverse, under climates the most various, age after age, through endless generations of man, these diseases pass down through the human body (sometimes through animals—*e. g.*, ovine small-pox?), perpetuating their own kind, and each maintaining its separate identity, by marks as specific as those which distinguish the asp from the adder, or the hemlock from the poppy.” Such being the case, it is difficult to conceive (as Drs. Watson and William Budd most justly observe), “*that diseases of whose propagation this is the history can ever be generated in any other way.*” Most of these miasmatic diseases also are peculiar to man; while animals on their part are infested by a whole brood of communicable diseases—no less specific in their kind, each distinct from the other, and most of them, although some may be communicable to man, are incapable of multiplying in the human body. Cattle appear to be subject to a variety of malignant and communicable fevers, from which man is altogether exempt. 9th. Certain receptive conditions, or a predisposition (the nature of which is unknown), exists in individuals which appears essential to the development of the specific poisons and the establishment of the disease; and immunity against a repetition of the disease is generally conferred by one attack of the same disease—an im-

munity which has been proved by experiment on an enormous scale with regard to small-pox; and with regard to the other diseases of this kind, the belief in such immunity is deduced from extensive observation. But the immunity acquired by one attack of any of these diseases is of no avail against the rest. Measles, for example, renders the body proof against measles, but leaves it as open to small-pox as before, and so on of the rest. 10th. With regard to fermentation, putrescency or decomposition, there is some reason to believe (as shown in the previous chapter) that it may quicken the activity or facilitate the development of specific morbid poison, in the way of a predisposing cause. Dr. Budd, however, believes that this effect has been much overrated, notwithstanding the observations of Dr. Carpenter referred to in the preceding pages. Nevertheless, there is no small amount of circumstantial evidence tending to show that endemic conditions may be thus far favourable to the propagation of specific diseases, even to the extent of epidemics, in consequence of the predisposing agency of putrescent emanations; and, on the other hand, both endemic and epidemic influences are often held in abeyance by the tendency to decay, decomposition, and destruction of the specific germs, miasms, gases, or disease poisons themselves. They are stamped with the tendency to change and to perish. Like all organic substances which propagate from minute or invisible beginnings, myriads perish for one that is fruitful. This is especially demonstrable in respect of the Parasitic diseases, whose germs would overrun the world if they all came to maturity; but the extinction or the dispersion of the specific poisons is abundantly provided for through the operation of many natural causes; and by imitating some of these operations of Nature we may be able eventually to exterminate, or, at all events, greatly to modify the severity and reduce the mortality from many of these diseases.

The belief in the spontaneous endemic origin of the specific miasmatic diseases rests on evidence entirely *negative*—namely, the fact that cases do spring up in which it is impossible to trace the disease back to a personal source of specific propagation and dissemination—an event which is inherent in the very nature of these diseases. For the active principle of the poison is invisible, although the matter that is known to contain it may be capable of isolation and inoculation, as in small-pox; yet the existence of

the specific disease poison, is known to us by inference only. Again, we know that ample provision is made and ways are open for the dissemination of the active agent of propagation in a thousand unseen modes, so that it is obvious that the precise source of infection and its track must often baffle the wisdom of man to discover or trace out.

Cases thus constantly arise which appear to give countenance to the belief that the disease has had a spontaneous origin—*sporadic*, as it is termed. Numerous cases of small-pox occur which can never be traced to their source, or to communication with persons similarly diseased; yet the history of small-pox is decisive against the notion of its spontaneous origin; and if of small-pox, so for all the other specific Zymotic diseases of the same nature. Dr. Watson has well observed that “the small-pox never occurs except from contagion. *It was quite unknown in Europe till the beginning of the eighth century.* No mention of any such malady is to be found in the Greek or Roman authors of antiquity. Now, whatever may have been the deficiencies of the ancient physicians, they were excellent observers and capital describers of disease; and it is impossible that a disease so diffusive and marked by characters so definite and conspicuous should have escaped their notice, or have been obscurely portrayed (if known) in their writings. On the other hand, Mr. Moore, in his learned and interesting *History of Small-pox*, has shown that it prevailed in China and Hindostan from a very early period—even more than a thousand years before the time of our Saviour. That it did not sooner extend westward into Persia, and thence into Greece, may be attributed partly to the horror which the disease everywhere inspired, and the attempts that were subsequently made to check its progress, by prohibiting all communication with the sick, partly to the limited intercourse which then took place among the eastern nations, but principally to the peculiar situation of the regions through which the infection was diffused, separated as they are from the rest of the world by immense deserts and by the ocean.” (Watson, *Lectures on the Practice of Physic*, 3rd edition, vol. ii., p. 709.) “If anything were wanting,” writes Dr. Budd, “to show what is the true inference to be drawn from these events, it would be found in the fact that, *once imported into the West*, it spread with the most fearful rapidity and havoc; and that while almost all men are prone to take the disorder, large

portions of the world have remained for centuries exempt from it, until at length it was imported, and that then it infallibly diffused and established itself in those parts. In this country the (endemic) conditions for the spread of the disease existed in the most intense degree, as was shown by the event when the disease was once introduced. The long lapse of ages during which we remained entirely free from small-pox showed, with equal clearness, that, until this introduction occurred, all the conditions favourable to the development of small-pox were powerless to cause a single case. The spectacle witnessed in Europe was repeated over again in the Western World in a still more striking way. Our knowledge of the events here is precise and sure. There was no small-pox in the New World before its discovery by Columbus, in 1492. In 1517 the disease was imported into St. Domingo. Three years later, in one of the Spanish expeditions from Cuba to Mexico, a Negro, covered with the pustules of small-pox, was landed on the Mexican coast. *From him* the disease spread with such desolation, that within a very short time, according to Robertson, three millions and a half of people were destroyed by it in that kingdom alone." Again, "Small-pox was introduced into Ireland in 1707, when sixteen thousand persons were carried off by its ravages—more than a fourth part of the whole population of the island. It reached Greenland still later, appearing there for the first time in 1733, and spreading so fatally as almost to depopulate the island." (Budd, l. c., p. 35, *et seq.*) No common conditions of human life gave rise to such phenomena. Propagation from the actual poison of a pre-existing case was the one necessary and all-sufficient condition for these endemic outbreaks and their epidemic prevalence. The precise mode in which the miasmatic diseases, with their specific poisons, first came into existence is beyond our *ken*—hidden from us as yet by a veil, and remaining an inscrutable, at least an unpenetrated, mystery. But, everything tends to show that, once created, they all propagate only in one way, namely—by continuous succession.

Defective ventilation, inasmuch as it is always injurious to health, always tends to cachexiæ—always, also, aggravates disease, and so promotes the endemic influence. With regard to any influence it may have on the development and spread of communicable disease, it may be noticed that it does not equally help

all communicable diseases to develop themselves and to spread. Commonly it seems to operate in proportion as the specific miasmatic disease is one which imparts specific poison properties to the general exhalations of the sick. The significance of defective ventilation is not likely, therefore, to be quite the same where typhoid fever, cholera, or dysentery are the prevailing diseases, as where the disease is typhus fever, scarlatina, small-pox, or diphtheria. In the cases of typhoid fever, cholera, and dysentery, any defect of ventilation would become more and more important in proportion as the bowel discharges of the sick were not promptly removed from within doors, or as, from other causes, there were fæcal effluvia or excrements suffered to remain in the dwelling. (Simon, *Third Report of the Medical Officer of the Privy Council*, 1860, p. 10.)

Epidemic Influence.—The second characteristic feature peculiar to some of the miasmatic order of Zymotic diseases, is, that they sometimes spread rapidly, so as to incapacitate and destroy great numbers of the people. The disease is then said to be *epidemic* (ἐπι, upon; and δῆμος, the people). No subject has afforded greater scope for speculation than the origin, cause, and progress of epidemics. It is in vain to speculate upon the subject; and, in the words of Dr. Wood, of Pennsylvania, “all we can say, with certainty, regarding epidemics, is, that there must be some dis-tempered condition of the circumstances around us—some secret power that is operating injuriously upon our system—and to this we give the name of *epidemic influence* or *constitution*,” and which is believed to predispose towards the receptivity of specific disease poisons. The observations, also, of Mr. Simon lead to the belief that the prevalence of external conditions, tending in certain localities to determine a specific decomposition of excrement, communicable to other organic substances and infecting the air, is an essential element in an epidemic period.

The most recent speculation regards the discovery of a peculiar atmospheric condition, ascribed to a principle called *ozone*, or *osmazone* (ὀζων, stink, or ὀσμὴ, smell), of which, as yet, we know nothing definite; although many subtle instruments and apparatus are in use to detect and measure the amount of this principle in the air.

A careful study of the effects of the *epidemic influence* appears to warrant the enunciation of certain laws which seem to regulate

its operations. These laws are thus condensed from the statements of Dr. Wood:—

Laws of Epidemic Influence.—(1.) This influence frequently predisposes to diseases, apparently independently of any other known cause, as in the case of influenza and cholera. It makes itself manifest, also, by appearing to give increased energy to causes which produce particular diseases: so that small-pox, scarlatina, typhus, and the like, sometimes rage with great violence as epidemics. It also appears to predispose to new and anomalous forms of disease, as witnessed in the furunculoid epidemic, which recently prevailed both in Europe and America, from 1849 till 1852. (2.) Sometimes the *epidemic influence* manifests itself by a certain type or direction, which existing diseases appear to take. Thus at one period diseases take a low, or what is called a *typhoid* type, so that depletion is not tolerated; at another time, an *inflammatory* tendency predominates, and antiphlogistic treatment is required. At one period, also, there is a tendency in disease to complicate its course by a disposition to affect particular organs. At one time head affections predominate; at another time affections of the chest, or of the alimentary canal, complicate the course of a prevailing disease. Consequently the same disease may demand very different, and even opposite modes of management. (3.) During epidemics other diseases are apt to assume more or less of the prevailing epidemic features. Thus, when cholera prevails, looseness of the bowels often complicates the course of other affections. When influenza prevails, catarrhal complications increase the danger of other diseases. Ill-health of any kind, therefore, favours the action of the epidemic influence. (4.) Some change in the character of prevailing diseases of a constant and recurring kind often indicates the approach of an epidemic and the prevalence of the epidemic influence. (5.) The first effects of the *epidemic influence* are usually the most violent and marked, and the cases of the epidemic disease become mild as the *epidemic influence* passes away. (6.) *The epidemic influence* sometimes disappears entirely after a short prevalence; sometimes continues with irregular intermissions for two, three, four, or even six years, or longer. Influenza and cholera are examples. (7.) An epidemic tendency, after continuing for several years, may give place to one of a different kind, which, in its turn, may again give place to the first. *Malarious fevers, yellow fever, and*

typhus illustrate this in America. The eruptive affections seem to run in somewhat similar cycles. After the introduction of vaccination the *small-pox* seemed for many years to be almost entirely subdued; but more recently again the disease has seldom been entirely absent from among us, alternating as an epidemic now and then with *measles*, *scarlet fever*, and *typhus*. We look forward to the time when vaccination, enforced by law, will predominate, and in time completely eradicate the disease. (8.) The lower animals are also subject to epidemic influences; and seasons of unusual fatality among them have coincided with those in which the human race have suffered. This fact has been well shown in an elaborate and erudite analysis of the census of Ireland, by Mr. William R. Wilde, of Dublin, the diseases of the population having been recorded at the time.

Pandemic Influences.—The expressions of the hitherto prevailing doctrines regarding *endemic* and *epidemic* influences appear so unsatisfactory to many minds, and leave many circumstances regarding the spread of diseases unexplained, that attention is being directed to more comprehensive views and investigations of the questions involved in the preceding paragraphs. An ingenious theory has been propounded by Deputy Inspector-General Dr. Lawson, as already mentioned in a note to page 207. Dr. Lawson has attempted to establish the occurrence, between 1817 and 1836, of a series of *oscillations of febrile diseases*, following each other over the world with amazing regularity. The mode of occurrence of such febrile diseases he attributes to a cause or influence which, from its extent and *progressive* character, he names a "*pandemic wave*," to distinguish the influence from that usually understood as *epidemic*, referring to a single form of disease affecting a limited space. Under the influence of this *pandemic wave* Dr. Lawson believes that there is a constantly progressive tendency to the development of all and various *endemic* febrile diseases in the Atlantic and Western parts of the Indian Ocean, from South or South-east to North or North-east.

But the facts and data on which this theory is made to rest are not of sufficient number, and many of them are not sufficiently trustworthy to rest a judgment upon. In not a few instances, also, a totally different interpretation may be given to that which Dr. Lawson has assigned to them. Although, therefore, it may be premature to propound such a theory, especially as it is

still open to the verdict of "not proven," yet the expression of it is calculated to do good by drawing attention to the subject, and to the comprehensive, world-wide range which must be given to such investigations; and to whom can Science look with more hope for results than to the medical officers of Her Majesty's British and Indian armies?

A successful study of these peculiar and characteristic features of miasmatic diseases, namely, the *endemic*, *epidemic*, and *pandemic influences*, is of the utmost importance to the student. He will learn to appreciate how much and successfully mortality may be diminished by well-directed hygienic measures: such as, cultivation and improvement of the soil, extension of commerce, improvements in diet, and the social circumstances of the lower classes—especially in regard to cleanliness, ventilation, and domestic management of improved dwellings, and efficient sewerage; care in the separation and treatment of the sick when in numbers, and the use of strict measures of a prophylactic kind suited to the circumstances of the case. Next to large towns, the health of the Army is of the greatest importance, especially when we consider the tendency that exists to a high rate of mortality in that service. In the military age (which is the age between eighteen to forty) the mortality of the general population in England is less than one per cent. per annum. The mortality of the British army is much above this. On Home service it has had a mortality double that of the civil population at the corresponding ages; and seven-ninths of the entire mortality among the infantry of the line has arisen from diseases of the Zymotic class. Disease and mortality are much greater during campaigns, when more than twenty-two per cent. are constantly on the sick list. The causes of high rates of mortality require constant investigation, by carefully observing, recording, and comparing the facts over a sufficiently large area, thus arriving at certainty as to the causes, and whether they can be mitigated or removed.

An observation of great interest in connection with *animal malaria poison*, as well as with *epidemic influences*, may be appropriately referred to here. It seems clearly proven, especially by the valuable and decisive observations of Dr. William Budd, of Bristol, that the communicable poison property of typhoid fever and of cholera are capable of being imported or carried

from place to place by persons who have the disease. Dr. Budd's history of the North Tawton fever and its offshoots (*Lancet*, July 9, 1860) is most conclusive on this point. His arguments are also cogent to the general effect, that *specially* the bowel discharges are *means* by which a patient, whether migrating or stationary, can be instrumental in disseminating typhoid fever and cholera. Mr. Simon makes the important remark, however, that these bowel discharges may not be the *sole means* of multiplying and disseminating these diseases; although, provisionally, the conclusions of Dr. Budd must be acted upon in their present unqualified form; while it is of the greatest practical importance to learn, as exactly as possible, whether it is in all states of the disease, and under all circumstances, that the bowel discharges of typhoid fever and cholera can communicate and multiply the means of dissemination. In illustration of such possible contingent results, Mr Simon refers to some interesting and important experiments made in 1854 by Professor Theirsch, of Erlangen. These experiments seemed to show that cholera evacuations, *in the course of their decomposition*, either acquire the power of communicating or multiplying their specific poison, or that the specific poison inherent in them becomes intensified by decomposition (Zymosis?) That the decomposition or change may begin even in the bowels, after the secretion and accumulation of the material in them, as well as in cess-pools, seems to be possible; and perhaps, as Mr. Simon justly remarks, may furnish an explanation of the many cases in which human intercourse has apparently disseminated the disease. For, according to the observations of Professor Pettenkofer at Munich, and Professor Acland at Oxford, it would seem that during cholera periods the immigration of persons suffering diarrhoea has been followed by outbreaks of cholera in places previously uninfected; and Professor Pettenkofer ascribes this fact to an influence (Zymotic?) exerted by the fæces of such diseased persons in the cess-pools and adjoining soil of ill-conditioned places to which they go. Specific poison properties of this kind would thus probably extend to the polluted well waters of such soils, and might thus render them, if swallowed, capable of exciting cholera, or typhoid fever, or dysentery, by direct *contagion*. It is encouraging to sanitary reformers, as Mr. Simon justly remarks, that cases of the apparent introduction of cholera contagion by

human intercourse are essentially different from cases of the dissemination of such specific diseases as small-pox or measles. The multiplication of the specific poison in the latter diseases takes place exclusively within the human body. The multiplication and dissemination of them have no immediate dependence on differences of medium; but wherever human beings can cross one another's path, to the susceptible or unprotected person these specific diseases may be communicated. On the other hand, it seems really to be the fact that the cholera poison (and probably, also, typhoid fever poison and dysentery), if it can at all be multiplied within the body, almost certainly has its great centres of multiplication *elsewhere*; namely, in those avoidable foci of corruption where excrement accumulates and decays. Military authorities ought to remember this fact. They have had abundant evidence of it in the old camping grounds of the Indian army; as well as when following the route and encamping on the ground previously occupied by retreating armies. For disseminating the disease and multiplying the poison, foulness of medium seems indispensable; and it is no ordinary foulness which will impart to air, food, or water the Zymotic action of decomposing excrement. The common taint is something specific. Therefore, as regards cholera, it seems highly probable that the immigration of infected persons might occur to a very great extent without exciting epidemic outbreaks, if such immigration were only made into places of irreproachable sanitary conditions, especially as regards water supply, and the continuous removal of house refuse or camp filth. (Compare Simon in his public health reports—especially *second* and *third*—relative to the people of England; also Pettenkofer, Acland, and Thiersch, as quoted by Simon, p. 3 of his *third* report, 1860.)

CHAPTER IV.

MANAGEMENT OF EPIDEMICS; AND ON PROCEEDINGS WHICH ARE
ADVISABLE TO BE TAKEN IN PLACES ATTACKED OR THREAT-
ENED BY EPIDEMIC DISEASES.

THE practical questions immediately involved in the exposition which has been given of the nature of Zymotic diseases in general, and of the miasmatic order of these diseases in particular, is contained in the following statement, namely:—That it is possible to extinguish the greater number of epidemic diseases, however intense or abundant may be the atmospheric or other agencies which constitute their potential causes, by remembering,—(1.) That the living body of the diseased persons is the soil on which the communicable disease breeds the poison by which the specific disease is multiplied and propagated: (2.) That excretions from an infected person, especially such excretions as are immediately related to or flow from parts affected with specific lesions, probably contain the most active elements of the specific poison by which the disease may be disseminated: (3.) That such active elements, germs, poisons, miasms, gases, or noxious agents may contaminate the drinking waters of a district, or may infect the atmosphere, or lie dormant for variable and unknown periods of time, just as seeds dry up and preserve their vital properties: (4.) To follow out zealously the hygienic measures which flow from these statements, and so prevent the propagation of specific diseases: (5.) To preserve as much as possible the blood of every individual in that state which shall prevent these poisons from finding the conditions of their development within the body: (6.) That these ends are to be attained on the one hand by preventing the production of fermentible matter in or out of the body; and on the other hand by promoting its removal and chemical destruction or decomposition, when it is inevitably generated, and by a free supply of pure air, and by the reduction of that air to the lowest temperature at which the condition of the individuals will allow it to be safely inhaled. Preventive measures based upon these principles are of the utmost importance, so much so, that the most eminent members of the

medical profession in London and elsewhere concur in the views and opinions of Dr. William Budd, unanimously cherishing the maxim, that, "except under the pressure of great military straits, no army ought ever to suffer on a large scale from this great group of communicable diseases, and especially such as are disseminated by intestinal discharges."

The following detail of proceedings advisable to be taken in places attacked or threatened by epidemic diseases, are given mainly from a memorandum drawn up by John Simon, Esq., the Medical Officer of the Privy Council, and published in his *Third Report on the Public Health in England in 1860* :—

1. Wherever there is prevalence or threatening of cholera, diphtheria, typhus, or any other epidemic disease, it is of more than common importance that the powers conferred by the Nuisances Removal Acts, and by various other laws for the protection of the Public Health, be vigorously, but at the same time judiciously exercised by those in whom they are vested; and with regard to armies, that the instructions relative to the guidance of the Medical Officer in sanitary matters, contained in the *Army Regulations*, be duly carried out, on the principle that the executive should act under authority, in order to carry out the required measures efficiently.

2. If the danger be considerable, it will be expedient that the local authorities in civil life, and the commanding officers of armies, brigades, divisions, and regiments in military life, avail themselves, as soon as possible, of the medical advice within their reach, in taking measures of prevention and protection against the spread of epidemic influences.

3. Measures of precaution for prevention and protection are equally proper for all classes of society, civil and military. But it is chiefly with regard to the poorer civil population—therefore chiefly in the courts and alleys of towns, and at the labourers' cottages of country districts—that local authorities are called upon to exercise the utmost vigilance, and to proffer information and advice. Common lodging-houses and houses which are sublet in several small holdings always require particular attention.

4. Wherever there is accumulation, stink, or soakage of house refuse, or of other decaying animal or vegetable matter, the nuisance should as promptly as possible be abated, and precaution should be taken not to let it recur. Especially all com-

plaints which refer to *sewers* and *drains*, or to *foul ditches* and *ponding of drainage*, or to *neglect of scavenging*, should receive immediate attention. The *trapping* of *house drains* and *sinks*, and the state of *cess-pools* and *middens*, should be carefully seen to. In *slaughter-houses*, and other places where beasts are kept, strict cleanliness should be enforced.

5. In order to guard against the harm which sometimes arises from disturbing heaps of offensive matter, it is often necessary to combine the use of chemical disinfectants with such means as are taken for the removal of filth; and in cases where removal is for the time impossible or inexpedient, the filth should always be disinfected. Disinfection is likewise desirable for unpaved earth close to dwellings, if it be sodden with slops and filth. Generally, where cholera or typhoid fever is in a house or barrack, hospital or hut, the privies especially require to be disinfected.

6. Sources of water supply should be carefully and efficiently examined. Those of them which are in any way tainted by animal or vegetable refuse—above all, those into which there is any leakage or filtration from sewers, drains, *cess-pools*, or *foul ditches*—ought no longer to be drunk from. Where the disease is cholera, diarrhoea, or typhoid fever, it is especially essential that no foul water be drunk.

7. The washing and lime-whiting of uncleanly premises (houses, huts, hospitals, barrack guard-rooms, and the like), especially of such as are densely or multifariously occupied, should be pressed with all practicable despatch.

8. Overcrowding should be prevented. Especially where disease has begun, the sick-room should, as far as possible, be free from persons who are not of use or comfort to the patient.

9. Ample ventilation should be enforced. Window frames should be seen to, (1.) That they may be made to open, if not so made; and (2.) That they be kept sufficiently open. Especially where any kind of specific disease, communicable by infection of the air, has begun, it is essential, both for patients and for persons who are about them, that the sick-room and the sick-house, or hospital, be constantly and efficiently traversed by streams of fresh air. This is especially necessary at night, and steps should be taken to insure efficient ventilation even at some real or imaginary expense of comfort.

10. The cleanest domestic habits should be enjoined. Refuse

matters should never be suffered to remain or to linger within the dwelling, hospital, barrack-room, or hut. Such refuse must *at once* be removed, and at once disposed of or cast into the receptacle provided for it. All things or utensils which have to be disinfected or cleansed should always be disinfected or cleansed *without delay*.

11. With regard to material substances discharged or separated from the bodies of the sick, special precautions of cleanliness and disinfection are necessary. Among discharges or substances separated from the body which it is proper to treat as capable of communicating disease, are those which come, in cases of small-pox, from the affected skin; in cases of cholera and typhoid fever, from the intestinal canal; in cases of diphtheria and scarlatina maligna, from the nose and throat, and the exhalations from the skin and the lungs saturating clothes; likewise, in cases of eruptive fevers, measles, scarlatina, r  theln, typhus, and the like, the general exhalations of the sick, and especially so of the convalescing, probably in connection with the desquamation of the skin. The caution which is necessary with regard to such matters, must of course extend to whatever may be imbued with them; so that bedding, clothing, towels, and other articles which have been in use by the sick, do not become sources of mischief, either in the house to which they belong, or in houses to which they are conveyed. Moreover, in typhoid fever and cholera, the evacuations should be regarded as capable of communicating a similarly specific and infectious property to any night-soil with which they may be mingled in privies, drains, or cess-pools (THIERSCH). This danger of multiplying the sources of communicating disease must be guarded against by the chemical destruction, decomposition, or disinfection of all the intestinal evacuations as soon as they are passed from the bowels, and certainly before they are thrown away, and so "let loose upon the world." Above all, they must never be cast where they can run or soak into sources of drinking water.

12. All reasonable care should be taken not to disseminate disease by the unnecessary association of persons suffering from the specific communicable diseases, either with healthy persons, or in wards of hospitals, where patients suffering with other diseases are being treated. This care is requisite, not only with regard to the sick-house, ward, hospital, or ship, but likewise

with regard to day schools, places of public resort, courts of justice, and other places where members of many different households are accustomed to meet.

13. Where dangerous conditions of residence cannot be promptly remedied, it will be best that the inmates, while unattacked by disease, remove to some safer lodging. If disease begins in houses where the sick person cannot be rightly circumstanced and tended, medical advice ought to decide on the propriety or fitness of removing him to an infirmary or hospital. In extreme cases, special infirmaries may become necessary for the sick, or special houses of refuge for the endangered.

14. The questions of quarantine ought to be decided by the circumstances of the special case, the preceding principles being kept in view.

15. Privation, as predisposing to disease, may require special measures of relief.

16. In certain cases special medical arrangements are necessary. For instance, as cholera in this country almost always begins somewhat gradually, in the comparatively tractable form of what is called "premonitory diarrhoea," it is essential that, where cholera is epidemic, arrangements should be made for affording medical relief without delay to persons attacked even slightly with looseness of the bowels. So again, where small-pox is the prevailing disease, it is essential that all unvaccinated persons (unless they previously have had small-pox) should very promptly be vaccinated; and revaccination should also be offered, both to persons above puberty who have not been vaccinated since childhood, and to younger persons whose marks of vaccination are unsatisfactory.

17. It is always to be desired that the people should, as far as possible, know what real precautions they can take against the disease which threatens them; what vigilance is needful with regard to its early symptoms; and what, if any, special arrangements have been made for giving medical assistance within the district. Especially in the case of small-pox or of cholera, such information ought to be spread abroad by means of printed bills or placards. In any case where danger is great, house to house visitation, or personal inspection of all by discreet and competent persons, may be of the utmost service, both in quieting unreasonable alarm, and in leading or assisting the less educated and

the destitute parts of the population to do what is needful for safety.

18. These memoranda relate to occasions of emergency. The measures suggested must be regarded as of an extemporaneous kind. Permanent provisions for securing Public Health have not been in express terms insisted on. In proportion as a district or number of individuals, such as an army or a regiment, are habitually well cared for by its sanitary authorities, the more formidable emergencies of epidemic disease are not likely to arise.

As addenda to these memoranda, the following rules, the observance of which is enjoined by the government of the London Fever Hospital, might well be adopted under similar circumstances in military and in other civil hospitals:—

1. It is of the utmost importance to the sick and their attendants that there be a constant admission of fresh air into the room, and especially about the patient's bed, care being taken to prevent the wind from blowing directly on the patient.

2. Attention to cleanliness is indispensable. The linen of the patient should be often changed, and the dirty clothes, &c., immediately put into fresh cold water, and afterwards well washed. The floor of the room must be cleansed every day with a mop, and all discharges from the patient immediately removed, and the utensils washed.

3. Nurses and attendants ought to endeavour to avoid the patient's breath and the vapour from the discharges.

4. Visitors must not go near to the sick, nor remain with them longer than is absolutely necessary; they should not swallow their spittle, but clean the mouth and nostrils when they leave the room.

5. No dependence must be placed on vinegar, camphor, or other supposed preventions, which, without attention to cleanliness and admission of fresh air, are not only useless, but by their strong smell render it impossible to perceive when the room is filled with bad air or noxious vapours.

Processes of Disinfection.—These processes have been recommended by Professor Miller, of King's College, London. They cannot supply the place of cleanliness, ventilation, and drainage. They are artificial, and are used for exceptional purposes; the great natural disinfectant being *fresh air*, abundantly and uninterruptedly supplied.

1. For purposes of artificial disinfection, the agents which most commonly prove useful are, chloride of lime, quicklime, and Condyl's manganic compounds, and carbolic acid. Metallic salts, especially perchloride of iron, sulphate of iron, and chloride of zinc, are under some circumstances applicable. In certain cases chlorine gas or sulphurous acid gas may advantageously be used; and in certain other cases powdered charcoal or fresh earth.

2. If perchloride of iron or chloride of zinc be used, the common concentrated solution may be diluted with eight or ten times its bulk of water. Sulphate of iron or chloride of lime may be used in the preparation of a pound to a gallon of water, taking care that the water completely dissolves the sulphate of iron, or has the chloride of lime thoroughly mixed with it. Condyl's stronger fluid (red) may be diluted with fifty times its bulk of water; his weaker fluid (green) with thirty times its bulk of water. Where the matters requiring to be disinfected are matters having an offensive smell, the disinfectant should be used till the smell has entirely ceased.

3. In the *ordinary emptying of privies or cess-pools*, use may be made of perchloride of iron, of chloride of zinc, or of sulphate of iron. But where disease is present, it is best to use chloride of lime or Condyl's fluid. Where it is desirable to disinfect before throwing away the evacuations from the bowels of persons suffering from certain diseases, the disinfectant should be put into the night-stool or bed-pan when about to be used by the patient.

4. *Heaps of manure* or of other *filth*, if it be impossible or inexpedient to remove them, should be covered to the depth of two or three inches with a layer of freshly burnt *vegetable* charcoal in powder. Freshly burnt lime may be used in the same way, but is less effectual than charcoal. If neither charcoal nor lime be at hand, the filth should be covered with a layer, some inches thick, of clean dry earth.

5. *Earth near dwellings*, if it has become offensive or foul by the soakage of decaying animal or vegetable matter, should be treated on the same plan.

6. *Drains and ditches* are best treated with chloride of lime, or with Condyl's fluid, or with perchloride of iron. A pound of good chloride of lime will generally well suffice to disinfect 1,000 gallons of running sewage; but of course the quantity of disin-

fectant required will depend upon the amount of filth in the fluid to be disinfected.

7. *Linen and washing apparel*, requiring to be disinfected, should, without delay, be set to soak in water containing, per gallon, about an ounce either of chloride of lime, or of Condyl's red fluid: the latter, as not being corrosive, is preferable. Or the articles in question may be plunged at once into boiling water, and afterwards, when at wash, be actually boiled in the washing water.

8. *Woollens, bedding, or clothing*, which cannot be washed, may be disinfected by exposure for two or more hours, in chambers constructed for the purpose, and heated to a temperature of 210° to 250° Fahr.

9. For the disinfection of *interiors of houses*, the ceilings and walls should be whitewashed with quicklime. The wood-work should be well cleansed with soap and water, and subsequently washed with a solution of chloride of lime, about two ounces to the gallon.

10. *A room no longer occupied* may be disinfected by sulphurous acid gas, or chlorine gas,—the first, by burning in the room an ounce or two of flowers of sulphur in a pipkin; the second, by setting in the room a dish containing a quarter of a pound of finely-powdered black oxide of manganese, over which is poured half a pint of muriatic acid, previously mixed with a quarter of a pint of water. In either case the doors, chimney, and windows of the room must be kept carefully closed during the process, which lasts for several hours.

CHAPTER V.

DETAILED DESCRIPTION OF THE MIASMATIC ORDER OF ZYMOTIC DISEASES.

SECTION I.—ERUPTIVE FEVERS—*Exanthemata*.

SMALL-POX—*Variola*.

Definition.—*Small-pox in man is the product of a specific and palpable morbid poison, which is reproduced and multiplied during the course of the malady. After a definite period of*

incubation a remittent fever is established and followed by an eruption on the skin, and sometimes on the mucous surfaces, with other concomitant and occasionally succeeding affections. The eruption on the skin passes through the stages of pimple, vesicle, pustule, scab; and leaves marks or cicatrices on its site. The disease runs a definite course, and, as a rule, exhausts the susceptibility of the constitution to another attack.

Pathology.—The theory regarding the development of small-pox is, that a specific poison is absorbed and infects the blood, and after a given period of latency, gives rise to “primary fever,” which lasts from two to four days, till the eruption appears, when the fever for the most part *remits*. The secondary or specific action of the poison of small-pox, makes itself obvious by an eruption on the skin, and also sometimes on the mucous membrane of the eyes, nose, mouth, fauces, and great intestine. The eruption runs a given course;—namely, *pimple, vesicle, and pustule*—and when fully out, or at its height, the febrile phenomena, which had remitted, return, and give rise to what is termed the *secondary fever*. The occasionally succeeding morbid conditions are inflammation of the various tissues of the lungs, of the urinary organs, and, lastly, of the areolar tissue of the body generally, which often becomes the seat of an endless number of abscesses.

The occurrence of fever preceding the secondary or specific actions of the poison, or the appearance of the eruption, has scarcely an exception, and indeed in some instances it has been of so severe a character as to have destroyed the patient on the first onset. The remission or subsidence of the fever is also constant in mild cases, but in the severer forms of the confluent small-pox it sometimes runs on, and is constant. The recurrence of the “secondary fever,” and the exacerbation of the fever in severe cases at the time of the maturation of the pock, is also constant. The cause of this secondary attack has long been a difficulty in the pathology of small-pox. Some attribute the fever to the specific nature of the disease, while others consider it to result from the maturation of the pustules, and to be a *suppurative fever*—*symptomatic*, and dependent upon the local affection.

Another constant phenomenon in the development of small-pox, is that the secondary actions of the poison occasion a peculiar eruption, has only a few rare exceptions, and constitutes

a variety of small-pox sometimes noticed as the "*variola sine eruptione*." With this exception the eruption is uniformly present; but the affection of the mucous membranes is often wanting in mild cases, though rarely absent in severe ones. The poison also is apt to set up many tertiary actions, as inflammation of the lungs, of the urinary organs, of the eye, and of the areolar tissue. Generally it may be mentioned that the state and appearance of the eruption depends in a great measure upon the type and character of the fever, while the type and character of the fever may be modified by the organic functions and condition of the blood, especially as induced by vaccination.

The development of small-pox is traceable through certain stages, namely,—1st. The stage or period of incubation; 2nd. The febrile stage, or period of primary fever; 3rd. The exudative stage, or period during which the eruption appears and becomes fully developed; 4th. The suppurative stage, or period of secondary fever.

As the eruption, or formation of the small-pox pustule, is undoubtedly a marked characteristic of the disease, it requires particular description. It has itself certain definite stages in its development. It runs a given course of about eleven days, and in its progress undergoes many mutations. It is at first a pimple, then a vesicle, then a pustule, and lastly it forms the scab or crust. These various changes form so many stadia of unequal duration. The first, or stage of pimple, lasts from twenty-four to forty-eight hours; the second, or vesicular stage, four days; the pustular stage three days; while the last stage, or that of scabbing, lasts three days more, making the whole duration of the *normal* pustule ten or eleven days. There are varieties, however, of this disease, in which the formation of the pustule is irregular; as in the *confluent* and *horn* small-pox. In the latter the two last stages are singularly shortened, or absent altogether.

When the eruption in small-pox is of the distinct variety its first appearance consists of a number of small red pimples, about the size of a pin's head, more or less numerous, but separate and distinct from one another, and scarcely salient. On the second or third day of the eruption the second stage towards the development of pustules commences; and a small vesicle, which gradually enlarges, bound down and depressed in the centre, or *umbilicated*, forms on the apex of each pimple, and contains a

clear whey-coloured fluid. This vesicular stage lasts about four days, when the vesicle matures or "ripens" into a pustule. This process is so gradual that Dr. Watson says, if you examine the pustule closely about the fifth or sixth day, you may see, at least in many, two colours, viz., a central whitish disc of lymph, set in, or surrounded by, a circle of yellowish puriform matter. "In truth, there is in the centre *a vesicle*, which is distinct from the pus, so that you may puncture the vesicular portion, and empty its contents without letting out any of the pus, or you may puncture the part containing the pus, and let *that* out without evacuating the contents of the vesicle. The vesicles have even, by careful dissection, been taken out entire." The adherence of the altered cuticle to the cutis at some points, and its separation at others, produces the little compartments or dissepiments spoken of by some writers. These cavities are usually irregular in shape; and all who have examined these multilocular cavities agree in describing the existence of a white substance in them of the consistence of pulp or thick mucus, and which at first was supposed to be the specific exudation of small-pox. It is now ascertained that it is no pseudo-membrane, but is composed of the deeper and softened layers of the epidermis. This "disc" of softened epidermis covers the interior of the pustule, and extends from the centre to the raised circumference of the pustule in diverging rays, forming part of six or eight chambers of nearly equal size. In the structure of this disc the following elements are distinguishable from without inwards,—(1.) Large flat cells; (2.) Large cells not so flat, but more globular, with nuclei; (3.) Nearest the cutis are the cells and tissue of the rete mucosum (GRUBY, GLUGE, RAYER GUSTAV. SIMON, besides other observers of more early date). Will not some delicate process of organic analysis tell us what the *active principle* of the specific virus of small-pox is,—if it be capable of being so determined? While the maturation of the vesicle into a pustule is going on, a damask red areola forms around each pustule; and as the vesicle fills, the whole face swells, and often to so great a degree that the eyelids are closed. While the maturation is complete, the "*bride*," which bound down the centre of the vesicle, ruptures, and the pustule now becomes *spheroidal* or *acuminated*. About the eighth day of the eruption a dark spot is seen on the top of each pustule. At that spot the cuticle

ruptures, allowing a matter to exude, which concretes into a scab or crust; and during this process the pustule shrivels and dries up. The crust is detached between the eleventh and fourteenth days, leaving the cutis beneath of a dark reddish-brown hue—a discoloration which lasts many days or even weeks. On the face, however, the pustule often penetrates or burrows, so as to cause ulceration of the *rete mucosum*, leaving a permanent cicatrix in the form of a depression or “pit.” The cicatrix thus formed, though at first of a reddish-brown, ultimately becomes of a dead white colour.

The small-pox eruption does not appear over the whole body at once, but appears in three successive crops. The first crop covers the face, neck, and upper extremities, the second the trunk, while the third appears on the lower extremities. There is usually an interval of several hours between each crop; and, the later the pustules are in appearing on the trunk and lower extremities than on the face and neck, by so much the later they are in maturing and in disappearing from those parts. When the eruption on the face is declining, that upon the extremities has scarcely yet arrived at its height, so that the hands and feet are then considerably swollen. This is to be regarded as a favourable sign, in so far as it indicates a certain vigour of constitution.

The number of pustules is very various, sometimes not exceeding five or six over the whole body, more commonly from one to three hundred, and occasionally amounting to several thousands. It has been calculated, if ten thousand pustules be counted on the body, that two thousand at least will be found on the face; and accordingly, the number of pustules on the face being in proportion, those on the other parts of the body furnish a fair estimate of the extent of the disease, and of the danger of the patient.

The pustule is subject to many irregularities, both as to its form and course; which give rise to two very marked varieties of the disease, namely, the *confluent* and the *horn* small-pox. The *confluent small-pox* differs from the *distinct small-pox* in the pimples being small, less prominent, and so numerous that even on the first appearance of the eruption there is hardly any distinct separation between them. The vesicles which form on their apices appear earlier, and their diameters increase more

irregularly than in the distinct forms, and often they run one into the other. The pustules, likewise, which are confluent, either remain flat and do not rise, or the areolar tissue rupturing, they form large bullæ or bladders (*variolæ corymbosæ*), and are not encircled with the usual red areola round their base; neither do their fluid contents always acquire the yellow colour and thick purulent consistency of the milder disease. Their crusts, moreover, are soft, and do not fall off till many days after the usual period, or not till the eighteenth or twentieth day, or even later. When the desiccation is completed and the crust detached, a deep scar or pit, sometimes an extensive seam, remains, and shows the loss of substance that has taken place, and how destructive has been the process beneath these crusts.

The *horn small-pox* is a variety of the pustule, and is by much the mildest form of the disease. The pustule in this variety passes through the stages of pimple and of vesicle, but on the fifth or sixth day of the eruption, instead of maturing, the pustule shrivels, desiccates, and crusts, and the disease terminates three or more days earlier than in the usual course, and without the occurrence of any secondary fever. This is the form of the disease which so usually follows after vaccination.

Many other varieties have been described by the older authors, which are seldom if ever now seen, for instance, *black small-pox* (SYDENHAM); a *blood small-pox* (MEAD); a *siliquous small-pox* (FRIEND), in which the pustule resembles a small hollow bladder, but contains no fluid. These varieties of the pustule were probably occasioned by improper treatment, or by some rare idiosyncrasy, and are consequently not mentioned by modern writers. There is one variety, however, which is not uncommon, which is the *crystalline* or *pearl pock* (*variolæ crystallinæ*), in which the vesicle continues transparent, seldom matures, and has a tendency to become confluent. Every variety of the eruption, when the disease is severe, may be intermixed with petechiæ. Such are the chief features of the disease, so far as the development of the eruption is concerned; the sequel will complete the pathology.

Varieties and Symptoms of Small-Pox.—The species of small-pox to be described are,—(1.) *The Natural Small-Pox*; (2.) *The Inoculated Small-Pox*; (3.) *The Small-Pox after Vaccination, or Varioloid*. Of these in their order; and,

1. *Of the Natural Small-Pox.*

There are three varieties of this species, namely,—1st. The small-pox without eruption (*variola sine eruptione*); 2nd. The distinct small-pox (*variola discretæ*); and 3rd. The confluent small-pox (*variola confluentes*).

Symptoms of the Small-Pox without Eruption.—Sydenham and Frank observed in every variolous epidemic, that some few persons who have not previously had the small-pox, or, according to Frank, have neither had the small-pox nor been vaccinated, are seized during the time the small-pox is raging with all the symptoms of primary variolous fever, and which having subsided, they have afterwards been found insusceptible of the disease. Sydenham states that he has seen fatal cases of this kind attended with purple spots and bloody urine; and hence the “*variola sine eruptione*” of authors; which, when it occurs in the present day, is more usually regarded as a modification of small-pox, probably depending on the influence of vaccination.

Symptoms of the Distinct Small-Pox.—The symptoms of *variola discretæ*, or of distinct small-pox, may be divided into *four stages*. The *first stage* comprises the period of incubation or of latency—a period of time which varies according as the poison has been introduced by the mucous or cutaneous tissues. In the former case, or in natural small-pox, for example, the more usual time of latency is from ten to sixteen days; while in the inoculated small-pox the period of latency is from seven to nine days. The extremes, taking both forms of the disease, being from five to twenty-three days. Bärensprung, of Berlin, has lately recorded a most interesting fact, which demonstrates, in a more striking and definite manner, the period of latency; and which appears to be similar in persons who have been vaccinated, and in those who have not. He observed seven cases of small-pox, *all* of which were infected from the same source on the same day. In *all* of them the outbreak occurred between the thirteenth and the fourteenth day. Some of them were vaccinated and some were not. (*Annalen des Charité Kranken*, vol. xix., p. 103.) The *second stage* comprises the primary fever, which commences with the disease and terminates with the appearance of the eruption. The *third stage* commences with the eruption and terminates with the appearance of the secondary fever. The *fourth stage* commences with the secondary fever and includes all the subsequent phenomena.

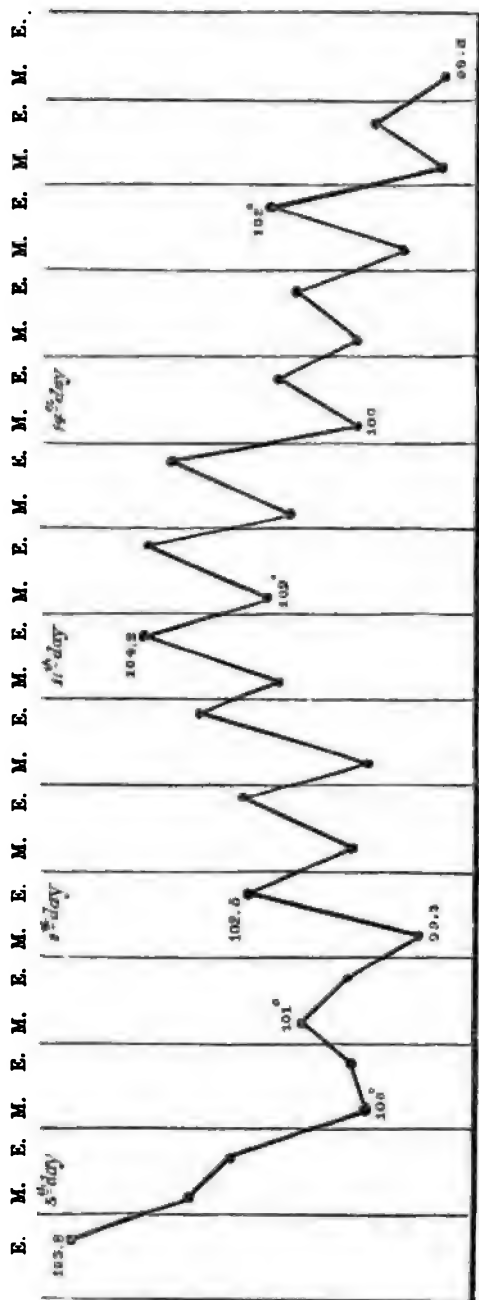
In the adult the symptoms of the second stage are mainly to be distinguished from those of the first stage of typhus, or other febrile affections by the characteristic ranges of temperature. There is, however, a great tendency to vomiting, and to pain in the back, and the brain is oppressed, as indicated by drowsiness, stupor, or coma, followed occasionally by convulsions. The ordinary duration of this fever is four days, and it may be sudden in its attack, or be preceded by some days' illness, in which case the most prominent and characteristic symptoms in the adult are severe muscular pains simulating rheumatism, especially in the small of the back, and the frequent occurrence of obstinate vomiting, foreboding a severe form of the disease.

On the fourth day inclusive from the first attack of the primary fever, sometimes sooner, and but seldom later, the eruption appears, and the third stage commences. The phenomena of the third stage are as a calm succeeding to a storm; for, on the appearance of the eruption, the fever remits, the heat abates, the affection of the head subsides, the vomiting ceases, and the pulse returns to its natural standard, and consequently the febrile phenomena have altogether disappeared for the time. A temporary defervescence is thus well marked, the temperature falling from, perhaps, 106° Fahr. progressively downwards to 100° Fahr.*

The number of pustules varies, according to the severity of the case, from about twenty to some thousands. They appear first in minute bright red specks on the face, neck, and upper extremities, then on the trunk, and lastly on the lower extremities, and run their course in a succession of crops. They undergo the various mutations of pimple, vesicle, and of pustule already described. About the eighth day of the disease, however, or when the eruption is fully out over the whole body, and the pustules on the face begin to mature, the whole face, head, and neck swell, particularly the eyelids, which often close and blind the patient; the swollen parts also throb and are painful when touched. The intumescence of these parts lasts three days, during which the spaces between the pustules inflame, and are of a deep red or damask-rose colour; and the closer this resemblance is seen to be, the milder will be the subsequent affections.

* A most useful *maximum* thermometer for clinical purposes is sold by Mr. Louis Casella, of 23 Hatton Garden, London, E.C.

TYPICAL RANGE OF TEMPERATURE IN A CASE OF NATURAL SMALL-POX, COMMENCING WITH THE *THIRD STAGE*; THAT IS, FROM THE PERIOD OF THE ERUPTION, ON THE EVENING OF THE *FOURTH DAY* FROM THE BEGINNING OF THE SICKNESS. THE RECORDS INDICATE MORNING (M.) AND EVENING (E.) OBSERVATIONS (Wunderlich).



Line of Normal Temperature, 98° Fahr.

It is during this period of intumescence, simultaneously with the renewed hyperæmia of the skin, and introductory to the change taking place in the contents of the pustule, that the fever, which had remitted, returns, and the *fourth stage*, or that of secondary fever, commences—the *Fever of Suppuration*. This stage, in cases of ordinary intensity, is marked by a rise of temperature to a considerable height, by a frequent pulse, sometimes by a rigor, and by slight delirium, from which the patient is easily aroused. If, however, the disease be of greater intensity, hæmaturia, hæmoptysis, or a hard dry cough are added. In favourable cases the swelling of the face, the redness of the intervening spaces, and also this secondary fever, having lasted from the eighth to the eleventh or twelfth day, subside, and the pustule, now fully ripe, bursts and discharges a thin yellow matter, which, concreting into a crust, falls off on the fourteenth or fifteenth day, and the disease terminates. During this somewhat protracted defervescence the temperature sinks gradually, to rise, perhaps, for the third time when the desiccation takes place.

In the very mild variety of distinct small-pox, which was wont to be named the "*horn-pox*," the primary fever is little more than a febricula; the pustules do not exceed half a dozen to two or three hundred; and, having passed through the stages of pimple and of vesicle, they on the eighth day, or about the usual time of maturation, shrivel, desiccate, and crust. The secondary fever, often so fatal, does not recur, so that the convalescence usually commences on the eighth day, and the disease is terminated on the eleventh.

It was once supposed that in such cases the pus of the pustules was absorbed, but it appears that pus does not form, the fluid always remaining serous. In cases of any degree of severity, even in the *distinct small-pox*, the poison acts not only on the skin, but also on the buccal and conjunctival membranes, and produces an exudation on those parts. This additional affection, however, does not appear to aggravate the fever, or to occasion other inconvenience than what arises from the local disease. The buccal eruption is usually preceded and accompanied by soreness of the throat and difficulty of swallowing, and sometimes salivation; but these symptoms do not exceed those of a common sore throat. The exudation upon the mucous membrane is generally resolved without the formation of ulcers, or anything that can be

considered a scab or cicatrix. The exudations which form within the eyelids are not attended with much pain, and it is only when the swelling has subsided that the mischief which sometimes takes place is discovered.

A peculiar faint and sickly odour, of a "greasy, disagreeable" kind, and quite *sui generis*, emanates from the small-pox patient during the period of maturation of the pustules. So much is this the case, that Dr. Watson says "one might name the disease at once by the smell." When, however, the disease assumes an unfavourable character, and threatens a fatal termination, the face, which ought to have been intumescent on the eighth day, remains without increase of size, and the spaces which ought to have inflamed are pale and white. The pustules also, says Sydenham, look red and continue elevated (even after death), and the saliva, which flowed freely up to this day, suddenly ceases. At this critical period the secondary fever, instead of its usual sthenic character, may assume one of two forms,—namely, either a form like the second stage of typhus, with brown tongue, frequent pulse, and delirium; or, the patient may be overwhelmed with the depressing influence of the poison, and sink almost without experiencing a re-action, the pulse being hardly increased in frequency, the heat of the body natural, and the intellect unimpaired. But the patient suffers from an indescribable restlessness, an inexplicable anxiety, some cough, with sickness, a frequent desire to pass urine, and with these symptoms he dies, after a short struggle.

Symptoms of the Confluent Small-Pox.—The confluent small-pox is described by Sydenham as beginning with symptoms similar to those of the distinct small-pox, but more violent; the second stage, or primary fever, being attended with more sickness and vomiting, with a higher temperature, with rigors, with more severe muscular pain, with more considerable delirium, and in children often, on the evening before the eruption, by convulsions. This fever is not only more intense than in the distinct kind, but is of shorter duration, and more tumultuous; the eruption appearing more generally on the third day, or even earlier; and the sooner the pustules appear, so much the more confluent is the disease that follows likely to be. The eruption is often preceded also by an extensive erythematous or erysipelatous inflammation, and the pimples come out irregularly, or in

small clusters, like the measles, and are less eminent than in the distinct small-pox.

When the third or eruptive stage is formed, the primary fever remits, but not so completely as in the distinct kind, for the pulse often continues frequent (110 to 120 in a minute), and the temperature does not fall so distinctly, the tongue is white, and even the delirium may recur in the evening. This eruption also has some remarkable characters; for the pustules, especially those of the face, do not rise; they are more irregular and flatter in their forms; and, from their greater number and contiguity, run into each other, or are confluent, sometimes forming bullæ as large as a hen's egg, and sometimes scarcely a portion of healthy skin is visible.

Other symptoms, sometimes seen in the distinct small-pox, never fail to accompany the second stage of confluent small-pox, namely, *sore throat* and *salivation*. The tonsils and the fauces become tumid and red; the face begins to swell, and then the salivary discharge begins either with the eruption or within a day or two afterwards. The discharge of saliva is at first thin and copious, resembling the ptyalism of mercury. About the eighth day, however, it becomes viscid, and is expectorated with difficulty; while in bad cases it either ceases for a day or two and then returns; or it disappears altogether abruptly; and if the swelling of the face also subsides suddenly, the danger is great. Children are not so liable to this salivation as adults. In them, however, a vicarious diarrhœa often appears, but not constantly, neither does it occur so early in the disease. It is frequently profuse, unless checked, and often proceeds till the disease terminates. Not unfrequently the larynx and trachea are implicated, even to the larger divisions of the bronchia. There is cough, with hoarseness, painful expectoration, and sometimes complete extinction of the voice. These are most dangerous symptoms.

It has been stated that, on the appearance of the eruption and the commencement of the third stage, although the fever is mitigated, it does not altogether subside, defervescence is incomplete, and the affection of the head, the frequency of the pulse, and greater heat of the surface, often continue. With these ominous symptoms still present, on the eighth day of the eruption, or the eleventh day of the fever, the fourth stage, or secondary fever,

commences, bringing with it new sources of anxiety to the physician and of danger to the patient. Gregory and Watson both consider the eighth day of the eruption as the most perilous day of the disease. Blood often appears in the urine in slight and sometimes in large amount. Renal cylinders are not uncommon. The bladder, also, is affected in a great number of cases, and there is increased mucus. If the urine be retained in torpid and semi-comotose cases, it becomes soon ammoniacal, as in all cases with catarrhal cystitis. (Parkes *On the Urine*, p. 262.)

"The confluent small-pox," says Sydenham, "does not in the least endanger life in the first days of the illness, unless there happens a flux of blood from the urinary passages, or from the lungs. Yet, on the decline of the disease, or on the eleventh, fourteenth, seventeenth, or twenty-first days, the patient is often brought to such a state that whether he will live or die is equally uncertain. He is first endangered on the eleventh day by a high fever (and the highness of the temperature may indicate the danger), attended with great restlessness and other symptoms, which ordinarily prove destructive, unless prevented by medicine. But should the patient outlive this day, the fourteenth and seventeenth are to be apprehended, for a very vehement fit of restlessness comes on every day towards evening, and there is the greatest difficulty in saving him." The disease is apt to prove fatal by way of apnoea, after the eighth day; but after that period the characters of asthenia supervene.

The fatal symptoms of the fourth stage are, the absence of the usual redness in the intermediate spaces, the non-intumescence of the face, the suppressed salivation, cough, with hæmoptysis, or hæmaturia, and great restlessness. Sometimes other symptoms are added to these, as a brown tongue, delirium, petechiæ, or a black spot in the centre of each pock, scarcely so big as a pin's head; or a disposition to gangrene in the large vesicles. When these symptoms are present few patients survive the crisis. In some cases, however, the event is favourable, and the patient is restored, but the struggle is sharp, and the convalescence long. In its progress an endless series of abscesses may form, or inflammation of a joint may take place and produce lameness; ulceration of the cornea, blindness, otitis, or deafness may also ensue; while the deeply-scarred face is a lasting record of the severity of the disease, and of the great danger the patient has survived.

2. *Of the Inoculated Small-Pox.*

Symptoms.—The phenomena which result from the introduction of the variolous poison by means of the cutis differ in many respects from those that occur in the natural small-pox; and they are as follows:—On the day after the operation is performed little alteration is discovered in the punctured part. On the second day, however, if the part be viewed with a lens, and the operation has succeeded, there generally appears an orange-coloured stain around the incision, while on the fourth or fifth day the part is hard, slightly inflamed, and itches, and a vesicle containing serum is formed on it. About the sixth day some pains and stiffness are felt in the axilla, symptoms which foretell the near approach of the fever and the favourable progress of the disease. On the seventh day the vesicle becomes more developed, and the red areola forms round its base.

The operation having now been performed seven, eight, or nine days (the usual period of latency of the poison when so inoculated), and the vesicle having existed four days, the ordinary symptoms of primary fever appear. This fever lasts three or four days, when the general eruption follows, now called the secondary eruption, the pustules coming out, as usual, in three successive crops, on the face, trunk, and lower extremities. On the day of the general eruption the primary pustule, says Dr. Gregory, is distended with matter, and proceeds on its course, so that it has scabbed when the secondary eruption is only about to mature.

The most remarkable phenomena, however, of the inoculated small-pox are the singular mildness of the fever and the diminished number of the pustules of the secondary eruption. The mildness of the fever is thus instanced by the late Dr. Watson, of the London Foundling Hospital:—"Of the seventy-four persons whose histories I have related, though inoculated with variolous matter in different states, although prepared in so different a manner, and a great number not otherwise prepared than by an abstinence from animal food, not one of them were disordered enough during the whole progress to occasion the least anxiety for the event; not one of them had their eyes closed a single day, from the pustules being upon the eyes or near them; none continued in bed an hour longer than they would have done in their best health."

The number of pustules is subject to great varieties, but, with very few exceptions, is much less than in the natural small-pox. In some cases not more than two or three appear, occasionally only the primary pustule is seen; but more generally the number varies from ten to two hundred, the mean being thirty or forty. Such is the general course of the inoculated small-pox. In a few instances, however, the disease that follows this operation is extremely severe, and in a still smaller number it is confluent; and in either case the patient is perhaps destroyed. Many theories have been propounded to explain the singular mildness of the inoculated small-pox, but none of them are satisfactory.

Complications of Small-Pox and Special Morbid Tendencies.—Small-pox having been chiefly studied previous to any sound knowledge of morbid anatomy, or of morbid poisons, the occasional subsequent affections of the disease are still but imperfectly known. About the eighth day in the distinct small-pox and the eleventh day in the confluent small-pox, a secondary fever is established, and at the same time a new series of phenomena may present themselves in a few severe cases,—as affections of the lungs, of the pleuræ, or of both, of the urinary organs, or of the areolar tissue of the body generally. It is during the progress of this *secondary fever* that frequent opportunities occur for its degeneration into a fatal type. In such cases complete deferescence is never established; but lesions become developed, whose advent is capable of being appreciated by careful records of morning and evening temperature during the progress of this *fever of suppuration*. These are the *tertiary affections*, the eruptions and the fever being the *secondary effects* of the specific poison.

The most frequent affection of the lungs is hæmoptysis, but occasionally inflammation of those organs takes place, generally as pleuro-pneumonia. The mucous membrane, for instance, of the trachea is found often covered with a thick semi-purulent muciform matter, peculiar to small-pox, irregular or honey-combed at its free surface, and which being removed, the subjacent tissue is found diffusely inflamed. The substance of the lungs also is occasionally found inflamed in every degree, even to purulent infiltration. The pleura also, according to Dr. Gregory, is peculiarly disposed to inflammation, which comes on about the

eleventh or twelfth day, for the most part very suddenly, proceeds rapidly to empyema, sometimes destroying the patient in thirty-six hours. The inflammation of the pleura does not merely run into suppuration, but takes every other form to which it is, at any time, liable.

The tertiary action of the variolous poison on the urinary and genital organs is seen in the frequent occurrence of hæmaturia, in the occasional formation of abscess of the kidney, in the occurrence of peripheric and parenchymatous orchitis, and in ovaritis; while its action on the uterus is manifest from menorrhagia in the unimpregnated state, and by frequent miscarriage when the patient is parturient. The areolar tissue of the body generally is also acted upon by this poison. In some cases examined a few hours after death, the bodies can with difficulty be laid on the table, the skin being detached by the pressure necessary to raise them; the serous coat of the intestines separates from the mucous and muscular coats with the greatest facility for many feet, and apparently might be entirely peeled off. In some cases the finger can be thrust through the walls of the heart with ease, as if the muscle of that organ had become unnaturally soft and broken down. This affection of the areolar tissue generally is seen in the great tendency to the formation of abscesses on the subsidence of the eruption; for twenty, thirty, and even more small abscesses will sometimes form on a limb or other part of the body in most formidable succession, and which, on being opened, are found to contain sanious, or, only in a few instances, laudable pus.

Pyogenic Fever.—In a case of septicæmia occurring during the course of confluent small-pox, examined by Dr. Parkes, the disease ran its course well till the eleventh day, when there was shivering; on the following day there was bilious vomiting; on the fourteenth day there was sudden pain in the right wrist, and swelling of many joints; and on the following day there were all the well-marked symptoms of pyæmia. A daily examination of the urine showed the remarkable fact that the amount of sulphuric acid passed continued progressively to increase daily—rising from 23·8 grains to 44·4 grains. (*Parkes On the Urine*, p. 267.)

Sequæ.—The different lesions that have been mentioned are not the only miseries from which the patient may suffer; for these are

often followed by sequelæ even more formidable than the preceding phenomena, as blindness, deafness, or lameness. With respect to blindness, it is generally supposed that pustules form on the conjunctiva or cornea, the inflammation then extending to the deeper-seated parts, and thus destroying the eye. Mr. Marson, formerly surgeon to the Small-Pox Hospital, says that, according to his experience, "The eye seems to possess a complete immunity from the small-pox eruption, and that although it sometimes extends to the inner margins of the eyelids, the particular local affection that causes the destruction of the organ of vision in variola begins generally on the eleventh or twelfth day, or later, from the first appearance of the eruption, and when the pustules in every other part of the body are subsiding. It comes on after the secondary fever has commenced, with redness and slight pain in the part affected, and very soon an ulcer is formed, having its seat almost invariably at the margin of the cornea. This continues to spread with more or less rapidity, and the ulceration passes through the different layers of the cornea, until the aqueous humour escapes, or till the iris protrudes. In the worst cases there is usually hypopion, and when the matter is discharged the crystalline lens and vitreous humour escape. In some instances the ulceration proceeds very rapidly; I have, more than once, seen the entire cornea swept away within forty-eight hours from the apparent commencement of the ulceration; and, what is singular, now and then the mischief goes on without the least pain to the patient, or his being aware that anything is amiss with his eyes." Further, he calculates that in 1,000 cases 26 had ophthalmia, or about 1 in 39; and of these 11 lost an eye each, or 1 in about 100.

The inflammation of the buccal membrane may extend to the Eustachian tube, causing suppuration of the ear, and sometimes permanent deafness. It may spread also to the glottis; and the patient has been known to die suffocated by effusion into the areolar tissue around it, causing occlusion of the aperture. Sometimes it has terminated in ulceration, with the loss of a portion of the nose, or in caries of the jaw-bone, or in enlargement of the glands of the neck.

The soreness of the fauces and tonsils is often associated with pustules on these parts; and the tongue, the roof of the mouth, the inside of the cheeks, the uvula, and the velum palati may

be covered with an eruption like pustules; and it has been much disputed whether the eruption forms on any other part of the mucous membrane. As a general principle, it does not; but Martinet found, in a man that died on the eighth day, the rectum covered with what he supposed to be variolous pustules. Rostan has seen the alimentary canal garnished with pustules similar to those of the mouth, from the cesophagus to the rectum. Sir Gilbert Blane also met with pustules on the mucous membrane of the intestines in two persons who died in the West Indies: and Rayer has given a plate representing pustules on the mucous membrane of the trachea. Dr. Mead's experience has made him state that, "I myself have seen subjects in which the lungs, brain, liver, and intestines were thickly beset with pustules." Dr. Pitzholdt, in the morbid anatomy of small-pox, writes that he has seen the peritoneum covering the liver and the spleen, presenting appearances which he felt justified in regarding as the product of the small-pox.

The pustules which form on the mucous membrane of the intestine, however, have not been very distinctly studied either as to their course or phenomena. Rayer terms them *rudimentary* pustules; and Dr. Watson believes the statement, that such pustules exist, to be a mistake.

A case of small-pox recorded by Dr. George Patterson, of Edinburgh, was examined by one of the most learned and discriminating pathologists of the day, Professor W. T. Gairdner. He observed pustules on the mucous membrane of the colon, and pronounced them to be identical with the pustules on the skin. (*Edinburgh Monthly Journal*, 1849, p. 549.) Still it appears to be doubtful whether such eruption on the mucous membrane of the intestine is not the same as that seen in cholera cases, extending (as I have frequently seen it do in cases I examined in the hospitals at Scutari, in 1855) throughout the whole intestinal tract. The appearance of eruption in such cases is due to the solitary mucous glands, which are filled with exudation not of a purulent kind, but having all the external appearance of pustules.

Such are the pathological phenomena which occasionally complicate small-pox. Death, however, not unfrequently anticipates their action, and destroys the patient during the primary fever, and before any of them are set up.

3. *Of the Small-Pox after Vaccination—Varioloid, or Modified Small-Pox.*

Symptoms, Course, and Modifications.—It has been already noticed that during the epidemic prevalence of small-pox, even before vaccination was known, cases of small-pox occurred in a very modified form: such as the occurrence of variolous fever without the eruption (*variola sine variolis vel eruptione*), or the occurrence of small-pox in which the eruption continued vesicular (*the crystalline pock*), and, lastly, the occurrence of small-pox in which the vesicles dried up instead of becoming mature pustules, and known as stone-pock, horn-pock, wart-pock (*variola verrucosa vel cornea*). Modern pathology now regards these varieties as the result of the modifying influence of vaccination: and they may now be all described and classed under the common name *varioloid*. Comparative mildness of symptoms and course is their great characteristic. There appears to be every variety in the nature of the modification, of which the principal are,—

1. A fever of three days, without eruption, affecting people during variolous epidemics.

2. A high and severe fever, followed by a very mild eruption, sometimes only a single pock: the slight proportion which the amount of eruption bears to the severity of the preceding fever is perhaps the most marked characteristic of varioloid.

3. The occasional appearance of a scarlet efflorescence like that of scarlatina or roseola, preceding the appearance of the proper pimples, which occur as a very scanty crop.

4. In some rare instances the eruption is confluent, but does not advance beyond the development of a pimple or vesicle, and begins to dry on the fourth or fifth day of the eruption, forming a small hard tubercle, which soon disappears.

5. Sometimes the eruption is at once pimple, vesicle, and pustule, at one time in the same case.

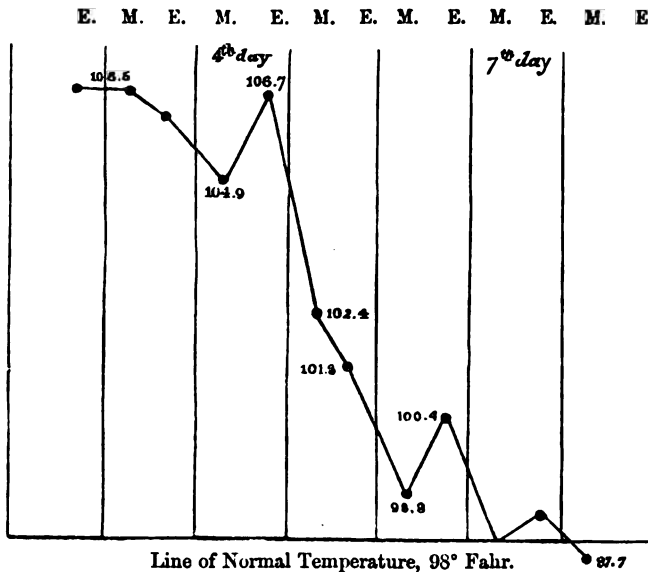
6. Sometimes the eruption runs its regular course, but stops sooner, sometimes on the sixth or seventh day instead of the eighth or ninth. In general, it may be stated that the severity and fully developed state of the disease is in proportion to the length of time which elapses from vaccination (COPLAND).

7. The varioloid eruption wants the peculiar odour of natural small-pox, and secondary fever is very rare.

8. Other eruptive affections—such as measles, scarlatina, purpura, materially modify the course and symptoms of small-pox.

Generally, it may be stated that, after an intense continuous fever lasting a few days, a final exacerbation terminates the fever suddenly and simultaneously with the development of the small-pox pimples. A rapid and perfect defervescence then ensues, the temperature decreasing seven or even more degrees (Fahr.) within thirty-six hours. From this event the patient remains entirely free from fever—*provided there exist no serious complication*—in spite of the continuous and progressive development of the small-pox pimples into pustules, and even in spite of the successive eruption of new pimples.

TYPICAL RANGE OF TEMPERATURE IN A CASE OF SMALL-POX MODIFIED BY VACCINATION. THE RECORDS INDICATE MORNING (M.) AND EVENING (E.) OBSERVATIONS, COMMENCING ON THE EVENING OF THE SECOND DAY (Wunderlich).



Exhaustion of Susceptibility.—The small-pox has the property, in common with measles and scarlet fever, of exhausting, on the first attack, the susceptibility of the constitution to the future actions of the poison. This law, however, is not without some

exceptions, and in an epidemic at Marseilles, Bosquet considered that one person in one hundred was attacked a second time with small-pox. In some few instances even a second attack has no protective influence. Dr. Roupel says he met with an instance in which small-pox occurred three times in the same person. The lady of a Mr. Guinnett had it five times. Dr. Maton speaks of a lady who had it seven times; while Dr. Baron mentions a surgeon of the South Gloucestershire militia, who was so susceptible that he took the small-pox every time he attended a patient labouring under that disease.

Co-existence of Small-Pox with other Morbid States.—The variolous poison is capable of *co-existing* with many other poisons, and also of influencing their actions, and of being reciprocally influenced by them. Dessessarz has seen variolæ co-exist with scarlatina and with whooping-cough; Cruikshanks with measles; Frank with psora; and Dimsdale with syphilis. A patient was admitted into St. Thomas's Hospital with tertian ague, writes Dr. Williams; the ague subsided and the small-pox appeared. The small-pox having run its course, the ague immediately returned. Ring mentions a case of triple disease co-existing, namely, small-pox, measles, and whooping-cough, and that they all ran their course together.

Cause.—The same obscurity hangs over the cause of small-pox as over that of many other diseases of the zymotic class, such as of measles and of scarlatina. There is every probability, however, that these diseases have now no other mode of communication than from one person to another. There are some grounds for believing, however, that small-pox, in common with some other distempers, originated in the lower animals, and extended from them to the human species by infection or contagion. Sheep, we know, are liable to a distemper of the nature of small-pox; and there is every reason to infer that the disease is perpetuated by its own specific poison, miasm, effluvium, or virus, which spreads it about by the media of impalpable substances, technically called "*fomites*," and which are capable of receiving, preserving, and carrying the germs of the disease. By such impalpable means the disease has been propagated since its first appearance in the world. The poisonous material of small-pox is given out from the mucous and cutaneous surfaces of a patient, especially from the lungs and skin, from the exhalations, the secretions, the

excretions, the matters in the vesicles and pustules, and the scabs. These all contain the noxious germs of the disease, which may attach themselves to bed-clothes, body-clothes, and especially to woollen, cotton, and felted articles. Such stuffs retain the specific poison for a very long, but undetermined, period: any number of years, so far as is known—just as the hat, cap, and coat, worn in a dissecting-room retain the peculiar effluvia of that place for a very long period.

It is not yet determined at what period this poison is first generated by the patient's person, whether during the primary fever, or not till after the eruption has appeared; but it probably begins to form and multiply during the primary fever. Generally, it may be stated that the poison is most powerful when it is most manifest to the sense of smell; that the dried crusts of the pustules or scabs possess the power of communicating the disease, and retain this power for a very long time. It is unsafe for a susceptible person—*i. e.*, a person who has not been vaccinated, or has not had small-pox—to be in the same room, or in the same house, with a patient labouring under the disease. It has been caught by passing a child ill of small-pox in the street; so that “to expose a person in the public highway, infected with this contagion, is considered a common nuisance, and indictable as such.” The dead body of a variolated person is equally infectious, and students who have been near it when brought into the dissecting-room have in consequence had the disease communicated to them, although they may not have touched the body (CÆSAR HAWKINS). The *infecting distance*, therefore, must be many yards around the patient's person: indeed, with every precaution, there is great difficulty in preventing it spreading from ward to ward in large hospitals during the prevalence of the disease. “There is no contagion so strong and sure as that of small-pox: none that operates at so great a distance” (WATSON).

The fact that small-pox is communicable has been fully demonstrated by the once general practice of inoculation. The poison by this operation has been proved to exist in the serum, in the pus, and in the crusts of the small-pox pustule. There is no law more singular and unexpected, in the whole range of morbid poisons, than that the introduction of the variolous poison, by means of the cutaneous tissue, should produce an infinitely milder disease than when the same poison is absorbed by a mucous

tissue. Then the poison seems to be much more uncontrollable in its operations, as in the case when it affects a person who breathes an infected atmosphere, compared with one who has been *inoculated* with the small-pox poison inserted beneath his cuticle through a puncture of the skin. Several explanations are put forward, namely,—(1.) That the small quantity of the poison conveyed by inoculation into the blood may make the difference; (2.) That the disease is milder when the poison is admitted through the cutaneous than through the mucous tissues; (3.) It may be held that in passing through the absorbent mucous membrane the poison is not only admitted in large quantity, but its potency may be increased and its amount multiplied by the living cells of the mucous membrane through which it passes.

The causes which predispose to small-pox or increase the susceptibility of infection are,—(1.) A very early age. (2.) Not having had the disease before. (3.) Not having been vaccinated: such are called “unprotected persons.” (4.) Peculiarity of constitution—*e. g.*, the Negro and dark races. (5.) Fear of infection. (6.) Epidemic influence.

It is gratifying to know that of recent years the prevalence and mortality of small-pox in this country is greatly less than was wont to be. Dr. Farr tells us that, for the three years previous to 1855, out of every 1,000 deaths from all causes, only 7·607 were from small-pox.

Prognosis and Causes of Death.—The prognosis of the natural small-pox is always most grave. The danger may be measured, to a certain degree, by,—(1.) The quantity and confluence of the eruption; (2.) The state of the circulating fluids; (3.) The presence and nature of the complications, especially those of the respiratory organs and nervous centres; (4.) Age, and habit of body of the patient; (5.) Nature of the epidemic constitution which may prevail.

Natural small-pox in unprotected persons is generally very fatal. The deaths average one in three. The fully formed confluent small-pox is always very dangerous. About one in ten die of distinct natural small-pox; and one to three per cent. only of small-pox after inoculation or after vaccination. The calculation of the proportionate number of deaths, however, appears to have greatly varied in different years.

There are certain signs regarded as unfavourable, for example

excessive lumbar pains continuing; the persistence of vomiting after the appearance of the eruption; the occurrence of delirium, convulsions, or coma in adults during the primary fever; great confluence and simultaneous appearance of the eruption over the whole body. Such unfavourable signs are not necessarily fatal; but unfavourable signs which appear during secondary fever forbode, with greater probability, a fatal end. These are:—the absence of the usual redness in the intermediate spaces; the distribution of petechiæ in the interstices; the development of a black spot hardly so large as a pin's head in the centre of each pustule; a livid or purple colour of the pustule; a disposition to gangrene in the larger vesicles; imperfect development of the pustules, or their sudden subsidence, without remission of symptoms; sudden suppression of salivation; sudden suppression of urine; hæmaturia; cough with hæmoptoë; absence of swelling in the hands and feet when the eruption is copious; tendency to the formation of abscesses (*pyogenic fever*) after desquamation has commenced; congestive pneumonia, or bronchitis, with livid lips, face, or extremities, with hoarseness or complete aphonia. Recovery may take place even although the first-mentioned of these unfavourable signs exist; but convalescence is likely to be retarded by ulcerations of the cornea, asthenic ophthalmia, purulent deposits in the joints, ulceration of cartilages, otitis, abscesses and suppuration in the areolar tissue under the skin.

The development of scrofula and phthisis is apt to follow the disease, even though no unfavourable symptoms occur. In pregnant women the disease is always dangerous, often fatal, and almost always produces abortion; and the fœtus so parted with not unfrequently bears evidence of small-pox upon the skin.

The most common causes of death are due to combinations of the unfavourable signs already noticed; and, according to Dr. Gregory's observations at the Small-Pox Hospital in 1828-29, the greatest number die on the eighth day of the eruption; or, the eleventh day of the fever is the most fatal period. In private practice, Dr. Wood, of Pennsylvania, considers the period between the twelfth and eighteenth day as the most dangerous to life. The greatest mortality from small-pox is in the early periods of life, for example, before the fifth year. Dr. Farr estimates that, out of every 100 deaths from small-pox, 75 are below that age.

Diagnosis.—It is not possible to distinguish, except by careful

records of the temperature, the primary fever of small-pox from that incident to many other diseases with eruptions, or from the first stage of continued fever. It is for the most part characterized by excitement rather than depression; and in the adult, the muscular pains and pains in the back and loins are more severe and intense than in ordinary fever. The pain of the back is central in its position—a *spine-ache*—and is less affected by change of posture than the pain which is characteristic of lumbago, which affects the muscles at the side of the spine (often on one side only), and which is much aggravated by movement (BARCLAY). If vomiting occurs, which cannot be ascribed to any obvious cause, and persists till a papular eruption appears on the third or fourth day, with a remission of the febrile symptoms, little doubt can exist as to the variolous nature of the disease.

The diseases with which it may be, at first, confounded are, *petechial eruptions*, *measles*, and *chicken-pox*, and the *secondary pustular eruptions of syphilis*.

The nature of the fever, the character of the eruption, and the absence of any tendency to suppuration, are sufficient to distinguish *petechiæ* from variolous eruption.

Small-pox is to be distinguished from *measles* by the symptoms, as well as by the form and successive changes of the eruption. Crescentic patches, terminating in desquamation on the fourth day, characterize *measles*, as compared with small-pox, the eruption of which, even although it may be at first in efflorescent patches, never fails to become vesicular and pustular, proceeding to suppuration or blackening on the eighth day—a process which never fails to be attended by secondary fever.

It is more difficult to diagnose between varioloid, and varicella or chicken-pox. The chief difference consists in the eruption of chicken-pox presenting a vesicular character, which it retains; and it does not proceed to suppuration, but completes its course in five or six days, with a mild and short symptomatic fever.

The combination of mercury, scrofula, and syphilis, often gives rise to cutaneous eruptions attended with fever, which may, in the first instance, be mistaken for small-pox. The eruption, however, is more tedious in its development, irregular in its course, and is persistent. It must, therefore, be distinguished by the history of the case, the long duration of the eruption, and the deep red or copper colour it generally presents.

Treatment.—Since the first accounts by the Arabian physicians of the ravages of small-pox in Mecca, the history of this disease may be arranged in three great eras, each of which is characterized by remarkable epochs, and a fourth may be said to be now becoming apparent. The first of these eras is marked by an improvement in the treatment of small-pox. In few diseases has medical opinion undergone a more obviously beneficial change. To Sydenham is due the merit of this revolution in medical practice. The second era is marked by the discovery of the singular and beneficial phenomenon, that the virulence of the poison of *small-pox* is greatly mitigated by introducing or ingrafting the disease into the system, through the cutaneous tissue, thereby causing the transference of the disease from one person to another, by inoculation. To Lady Mary Wortley Montague is due the merit of having introduced the practice of inoculation into this country in 1722; a deed which must be considered as one of great heroism, when measured by the knowledge possessed by physicians in those days. The third great era is marked by the remarkable discovery which has rendered the name of Jenner immortal,—namely, the modifying and protecting influence of vaccination. He found that a certain disease in the cow, known as the *cow-pox*, could be transferred to the human subject by inoculation; and that, having been so transferred, it modified, to a considerable extent at least, the course of the disease, if it did not altogether prevent the occurrence of small-pox in its natural state in the human subject.

A fourth era may be said to have commenced, in this country, almost imperceptibly. It may be described as a period of transition, marked in this country by doubt and scepticism as to the efficacy of vaccination, tending to propagate an erroneous popular belief; and consequently, the ineffective adoption of means which practically have been proved to be sanitive in the highest degree. In other countries, on the contrary, and especially in Central Europe, this period is marked by implicit faith in the virtues of vaccination, and the successful legal enforcement of this sanitive measure.

An account of the treatment of small-pox resolves itself, therefore, into the consideration of two topics, namely,—(1.) The usual therapeutic, curative, or sanitive treatment of the disease; (2.) The sanitary treatment—*i. e.*, the means of protecting indivi-

duals from the *small-pox*; or of modifying the influence of the malady by inoculation or by vaccination. Of these in their order.

(1.) *Therapeutic, Curative, or Sanitive Treatment of Small-Pox.*

The main object, in the first instance, is to prevent, if possible, a copious eruption; for the severity and danger of the disorder may be measured, in some degree, by this. The vulgar belief, that "better out than in," does not apply in the case of small-pox. The great object is to reserve the strength of the patient; and the attentions of an experienced nurse are demanded. A third indication is to watch for and deal vigorously with intercurrent inflammatory action which is apt to be set up. The disease is not under the influence of any specific. It must run its course. But, it is the business of the physician to assuage the untoward symptoms which may arise, by all the most approved methods of treatment, in accordance with the science of medicine of the present day.

Dietetic and General Treatment.—In the first instance, the course to be pursued is, for the physician to act on the defensive, and simply protect his patient from certain injurious influences to which he may be exposed,—such as heating drinks to force out the eruption, which are apt to be given by ignorant and officious friends. Throughout the whole course of the disease, the diet should be strictly limited to slops, sago, arrow-root, and ripe fruits.

The chamber in which the patient lies should be cool, and freely ventilated. The bed-clothes should be light; the body linen daily changed: and, when the disease is long, the patient's back should be often examined to prevent sloughing. The scalp likewise should be examined, and, if full of pustules, the hair should be cut off to prevent its matting. If the disease be diagnosed early, however, it is proper to shave the scalp, because the irritation which attends the suppuration of the pustules is thereby diminished, and cold may be more efficiently applied to the head, if necessary. In the early stage of the primary fever, in severe cases more especially, it is necessary to have the bowels well opened in the first instance, and to keep them regular by saline medicine. A cathartic pill, composed of the following ingredients will be found to be efficient in most cases, especially if

aided by a seidlitz powder, given six or eight hours after the pill:—

Two grains of calomel, one grain of the compound extract of colocynth, one grain of gamboge, and one grain and a half of scammony, made consistent with a little aromatic oil.

The bowels must be daily attended to afterwards, and castor oil or rhubarb, or magnesia, &c., may sometimes be required. Saline diaphoretics, in the form of James's powder; or the "*aqua acetatis ammoniac*," to which a grain or two grains of tartar emetic has been added, so as to have $\frac{1}{4}$ or $\frac{1}{8}$ of a grain in every table-spoonful of the mixture, becomes an efficient and cooling diaphoretic. Spirit of nitric ether or the nitrate of potass may be added if required.

The surface of the body over the hands, face, and feet may be sponged several times a-day with tepid water, with a view to relieve the intolerable itching; but caution is necessary to prevent exposure to cold. Cold cream, or a liniment of olive oil, glycerine, and lime-water, smeared from time to time over the itching surface by means of a camel-hair pencil may be found to afford relief; and chlorine lotions are highly spoken of by Eisenmann. With regard to the occurrence of convulsions in children, it is *not* found that opiates, as recommended by Sydenham and Cullen are expedient. When the children are robust, or previously in good health, local bleedings, by means of one or two leeches to the temples, are more beneficial. Delirium, violent screaming, intolerance of light or sound, heat of head, all of which indicate a tendency to meningeal congestion, still more clearly warrant the application of leeches.

With regard to the propriety of bleeding (general) in adults, it is now well ascertained that it will neither eradicate the fever nor diminish the amount of the eruption. Bleeding is only warrantable if the pulse be full and strong, combined with evidence of inflammatory congestion in any important organ, as in the head, the chest, or the abdomen. On the whole, local, rather than general blood-letting is to be preferred, and must only be adopted if danger threatens some important organ.

When delirium, with restlessness, wakefulness, and a frequent pulse, is continuous, an opiate is indicated; and, combined with tartar emetic, is most advantageously given. A draught com-

posed of thirty drops of the solution of muriate of morphia, with half a grain of tartar emetic, will be found beneficial in such conditions, and especially when given at bedtime.

Cooling drinks of lemon juice, tamarinds, neutral effervescing powders, are always agreeable to the patient; who ought also, for the sake of coolness, to be very lightly clothed. After the eruption has fully appeared, this is all which in ordinary cases requires to be done, and if, towards the tenth or eleventh day, there is much restlessness or sleeplessness, an opiate should be given.

When the febrile symptoms do not abate, as they ought, in the regular course of the disease, cathartics may be daily required to keep the bowels open. The most approved are the saline infusion of senna, or the black draught, the compound powder of jalap combined with calomel, and some aromatic powder such as ginger. In this disease the bed-clothes ought frequently to be changed, and abundance of cool fresh air supplied to the apartment. When the state of the skin *alone* seems to keep up the febrile irritation, an antimonial opiate may allay irritation and procure sleep, after which a cathartic may be given with advantage in the morning.

In the complications which sometimes ensue, such as *inflammation of the throat and base of the tongue*, opiates are found to be injurious. The general treatment must be by cathartics or purgative clysters if swallowing is difficult. In the other inflammations, however, opiates are of the greatest service, provided the symptoms be not of cerebral oppression; and local blood-letting is always to be preferred to general. In bronchitis nauseating doses of antimony every hour sometimes procure relief; and if relief does not follow in the course of thirty to thirty-six hours, doses of calomel and opium ought to be given every second hour till three dozes have been taken, each consisting of *two grains of calomel and half a grain of opium*. If the symptoms are not then relieved, this remedy need not be carried farther.

In the advanced stage of the secondary fever, the strength of the system requires maintenance and support; because the abundant suppuration and extensive cutaneous irritation combine to exhaust the strength, as shown by the weakened pulse, the dark and dry tongue, blueness, paleness, or coldness of the extremities. Tonics, stimulants, and generally nutritious diet, are now called for. Quinine, mineral acids, malt liquors, especially

the light bitter ales, wine, and even brandy, may be demanded. The diet should consist of milk, strong animal broths, eggs raw or well boiled, according to the discretion of the physician, regulated by the digestive powers of the patient.

To prevent the face from being seamed, scarred, or "pitted" by the suppuration of the pustules, has taxed the ingenuity of physiologists and physicians. It has been stated that the influence of the atmospheric air is essential to the development of the pustules; and accordingly, anything which would effectually exclude this influence would prevent the occurrence of a scar. But it is evident that the chance of scars can only be diminished by those means which are calculated to allay the general violence of the disease. When the eruption is severe it is almost impossible to prevent the formation of "pits," because the depression results from the expulsion of a small slough; and the more mild the suppurative inflammation can be rendered, so in proportion will the chance of "pitting" be diminished.

The local means adopted to prevent "pitting" may be shortly stated as follows :—

1. To open each individual pustule after suppuration has commenced.
2. To cauterize the pustules with nitrate of silver.
3. To employ both methods, that is, to open each of the pustules when it becomes vesicular, and introduce a strong solution of nitrate of silver into the cavity of the vesicle. At the end of a week scales fall off, and no pit is left. Or, lastly, to paint the face with a solution of nitrate of silver, in the proportion of one drachm of the nitrate to the ounce of water.
4. The application of a mercurial plaster with the view of producing resolution of the *papule*. The preparation in use for this purpose at the Children's Hospital in Paris consists of 25 parts of mercurial ointment; 10 parts of yellow wax; 6 parts of black pitch.
5. Sulphur ointment applied several times a-day.
6. Calamine mixed with olive oil to form a coherent crust (BENNETT).
7. Tincture of iodine, painted over with a brush.
8. Saturated solution of gutta percha in chloroform (DRS. GRAVES and WALLACE).
9. To smear the face over with common olive oil.

All of these applications are for the most part applied to the face, the hands, and the arms, only.

The severity and the mortality of small-pox has led many to

think of means by which the disease might be completely extirpated. This leads us to consider

(2.) *The Prophylactic, Sanitary, or Preventive Treatment of Small-Pox.*

Fifty years ago it was generally taught, among English physicians, that small-pox attacked the same individual only once in the course of life, and that its double occurrence in the same person was either very rare or next to impossible. The observations of Drs. Willan, John Thomson, Mr. Cross, Dr. Barnes, Dr. Craigie, and others since the time of these eminent physicians, lead to the following general conclusions:—

1. Small-pox, though in general attacking the same individual only once during the course of life, may, however, affect him a second, and even a third time.

2. This happens much more commonly when the first attack has been one of mild distinct small-pox, than when it has been severe; and if the first attack has been one of confluent small-pox, it is rare for the same individual to have a second attack.

3. It is established by numerous observations, that an attack of any one of the varieties which have been named spurious small-pox or chicken-pox, by no means secures the same individual from an attack of confluent small-pox at a subsequent period.

4. Small-pox produced by inoculation does not necessarily secure the individual against an attack of small-pox induced in the natural way.

5. Every previous attack, however, of small-pox, whether natural or inoculated, exercises some modification on that which succeeds. This modification may be various in degree, from very slight and almost imperceptible to very conspicuous and remarkable. In this modification the symptoms of eruptive fever may be mild and of short duration; and the eruption may consist of vesicles or hard pustules, which disappear without suppuration.

6. The most powerful modifying agent on the course of small-pox is the action of the cow-pox on the constitution, or the disease produced by the application of vaccine lymph to the exposed skin. The specific disease so induced, in a large portion of cases, not only renders the individual less likely to be affected by the variolous effluvia, but if he is affected, changes very much the characters of the disease which may supervene. Though the

fever which precedes the eruption in cases of this class be similar in form and equal in degree to that by which the inoculated small-pox is attended, the eruption is either papuliform or tuberculated, without much surrounding inflammation. A similar eruption is produced when vaccine and variolous matter are inoculated at the same time in the same individual; or when a person who is exposed to the variolous contagion has been inoculated with vaccine lymph early enough to mitigate, but not wholly to supersede, the eruption of small-pox. In such circumstances the vaccine lymph and variolous matter restrain and counteract the operation of each other on the system and on the skin. To these eruptions of modified small-pox the general name of *varioid* eruptions has been applied.

7. Cow-pox destroys the susceptibility to inoculated small-pox almost entirely; but the susceptibility to the natural disease, or that by inhalation, it does not entirely extinguish. This susceptibility, however, it diminishes in a much greater degree, and much more effectually than inoculated small-pox does.

8. The susceptibility to second attacks of small-pox,* and attacks of small-pox after vaccination, is principally favoured by the existence of an epidemic constitution of the atmosphere, and by the circumstance of early life, or the age below ten years. If no epidemic influence exists, the occurrence of second attacks of the disease may not be observed for a long series of years. But if, on the other hand, the atmosphere possess or acquire an epidemic or variolous constitution, then neither the circumstance of a previous attack of small-pox, nor vaccination, can insure many of those under ten years of age, and not a few between that and thirty from attacks of small-pox.

The preventive management of small-pox consists,—(1.) In the artificial production of the disease by *inoculation*, or *artificial variolation*; (2.) In the modifying and protective influence of *vaccination*.

Inoculation consists in the application of small-pox matter or virus to the surface of the corium, exposed by a puncture or scratch. The result is a local inflammation similar to small-pox, attended with an eruption and a fever, generally milder in form

* The average number of second attacks of small-pox seems to be one *per cent.* (R. Acad. of Med., Marseilles, 1828; and *B. and F. Med.-Ch. Rev.*, Jan., 1848, p. 74).

than small-pox, acquired by breathing an atmosphere contaminated with the specific poison of the disease; and which thus passes through mucous membrane to infect the blood. This is called the "natural way" of contracting small-pox; and the course of the disease so induced has been already noticed. For obvious reasons the operation of *inoculating* the poison of small-pox has been rendered illegal in this country; and the practice of vaccination has been attempted to be enforced by law. What remains to be said about *inoculation* will be considered under the next topic.

COW-POX—*Variolæ Vaccinæ*.

Definition.—*Cow-pox is the product of a specific and palpable morbid poison, which is reproduced and multiplied during the course of the malady in the cow or in the human being. After a definite period of incubation (from the time that the specific virus is artificially implanted, or communicated by impalpable emanations or effluvia in the "natural way") specific pimples form upon some part of the skin, which pass through the stages of vesicle, pustule, scab, and desiccation. During the maturation of these specific pimples the adjoining lymphatic glands swell; a febrile state is induced, denoted by increase of temperature, constitutional disturbance of functions, acceleration of the pulse (which, to a certain extent, has been observed to continue persistent in some cases); and a general lichenous, roseolar, or vesicular eruption, makes its appearance on the trunk and limbs. The disease runs a definite course, affords immunity from another attack (for a considerable time at least), and exercises (during that period) a protective influence from human variola.*

Pathology and Symptoms.—The importance of a comprehensive knowledge of the pathology of variolous diseases generally, and of *cow-pox* in particular, lies in the relations of this latter disease to *small-pox* and to *vaccination*. Dr. Jenner named the disease "*variolæ vaccinæ*" implying thereby that one genus at least of the animal creation is liable to a disease of a kindred nature with that which attacks man. The disease in the cow was observed to be generally mild; in man, it was observed to be most pestilential and fatal. It was observed, also, that the disease was communicable from the cow to man; and that persons so affected were protected from subsequent attacks alike of small-pox and

of cow-pox. Dr. Jenner believed that the two diseases were in reality identical. It has now been shown by unquestionable evidence that cattle and horses have for centuries been known to be affected with a species of small-pox or variola. Every different writer who has seen the disease has given it a similar name. Previous to 1745 it was known and described in Italy (FRACASTORIUS, LANCISI, RAMAZINI) as a malignant disease which destroyed cattle almost as extensively as small-pox did the human race. It was first observed in this country in 1745, and again, in 1770, it appeared among the horned cattle with so much severity that His Majesty George III., in his speech from the throne at the opening of Parliament on the 9th of January of that year, called upon the Houses of Parliament to take the subject into their serious consideration. The disease continued with more or less violence till 1780; and it was no doubt the expiring embers of this epizootic which Dr. Jenner found in Gloucester, and made the basis of his investigations during that and subsequent years. Dr. Layard described the disease amongst the cattle in England, in that year, in a paper communicated to the Royal Society; and he mentions that inoculation from cow to cow was successfully practised to mitigate the severity of the disease; just as Mr. Simonds, of the Veterinary College in London, is at this moment (1862) successfully practising inoculation of the variolous disease from sheep to sheep, or lamb to lamb, throughout the counties of Wilts, Hants, and Dorset, where *ovine small-pox* seems to be spreading fast. The great increase of mortality from small-pox among human beings, which occurred during the latter part of the last century, is a fact of some importance in connection with the epizootic disease; for, at other times and places it has been observed that, when the cattle were scourged by the variolous disease, mankind were in like manner great sufferers from a similar epidemic. In the interesting lectures "Introductory to the Study of Fever," by Dr. Andrew Anderson, of Glasgow, we are told that while small-pox was raging with great violence at St. Jago, on the west coast of New Granada—to which a town named David, in Chiriqui, was situated about sixty or seventy miles to leeward—a few days (four or five) before the disease appeared in this latter town, the small-pox had attacked and destroyed many monkeys in the forest. Dying and dead monkeys were seen on the ground, covered with the perfect pus-

tules of small-pox; and several sick monkeys were seen on the trees, moping or moving about in a sickly manner. In the course of a fortnight one-half of the inhabitants of the town of David were stricken with small-pox. (ANDERSON, p. 70.)

It is also within the experience of many medical men that, during the prevalence of small-pox, cattle are apt to become affected with cow-pox. Horses, as well as cows and sheep, are liable to the affection; and the countries where the disease of late years has been found, are those where it has formerly been known to have existed among cows or horses in its most virulent form. During the epidemics of small-pox previous to 1840, the variolous affections among the cows of the country were more observed than at any period for many years. In the dairies of Suffolk, of Gloucestershire, Dorsetshire, Buckinghamshire, the disease has prevailed not only during epidemic small-pox, but when no cases of variola were known to exist in the immediate neighbourhood. There are good grounds for the belief that the impalpable emanations—the specific effluvia—from cases of small-pox in human beings have been sufficient to communicate the variolous disease to cows. Mr. Ceely gives a most interesting history of such an occurrence in the tenth volume of the *Transactions of the Provincial Medical and Surgical Observations*. At the village of Oakley, about sixteen miles from the town of Aylesbury, small-pox had been epidemic from June to October, 1840. Two cottages, in which three persons resided during their illness, were situated on each side of a long narrow meadow, comprising scarcely two acres of pasture land. One of these three patients, though thickly covered with pustules of small-pox, was not confined to her bed after the full development of the eruption; but frequently crossed the meadow to visit the other patients—a woman and a child—the former of whom was in great danger from the confluent and malignant form of the disease. The woman died, and, according to custom, was buried the same evening; but the intercourse between the cottages across the meadow was continued. On the day following death the wearing apparel of the deceased, the bed-clothes, and bedding of both patients were exposed for purification on the hedges bounding the meadow; the chaff of the child's bed was thrown into the ditch; and the flock of the deceased woman's bed was strewed about on the grass over the meadow, where it was exposed and

turned every night, and for several hours during the day. This purification of the clothes continued for eleven days. At that time eight milch cows and two young heifers (sturks) were turned into this meadow to graze. They entered it every morning for this purpose, and were driven from it every afternoon. Whenever the cows quitted the meadow the infected articles were again exposed on the hedges, and the flock of the bed was spread out on the grass, and repeatedly turned. These things remained till the morning, when the cows were re-admitted, and the contaminated articles were supposed to be withdrawn. It appears, however, that the removal of the infected articles was not always accomplished so punctually as had been enjoined, so that, on one occasion at least, the cows were seen in the midst of them, and licking up the flock of the bed which lay on the grass. These cows were in perfect health when first put out to graze in this meadow; but in twelve or fourteen days *five* (out of the eight) milch cows appeared to have heat and tenderness of the teats. The teats became swollen, and small hard pimples could be distinctly felt upon them, as if imbedded in the skin. These pimples daily increased in magnitude and tenderness; and in a week or ten days they rose into *blisters* (vesicles), quickly passing into brown or blackish scabs. When the teats were in this condition and very tender, constitutional symptoms of ill-health became developed. Sudden *sinking* or loss of milk, drivelling of saliva from the mouth, frequent inflation and retraction of the cheeks, staring of the coat, "tucking up of the limbs," "sticking up of the back," and rapid loss of flesh, were the appearances which even the peasants themselves were able to appreciate. By the middle of the third week the pustules were mature, and the crusts and loose cuticle began to be detached. The simultaneous occurrence of the disease on all the animals increases the probability of the operation of one common cause. The whole of the cows were certainly affected within less than three days of each other; and another circumstance requires particular notice, namely, the occurrence of the disease in a young heifer (stark), to which of course the disease could not have been communicated by those casualties which commonly propagate the vaccine variola amongst milch cows. The cause which originated the disease amongst them at the same time affected the young heifer, which hitherto had not been considered liable to the

vaccine disease, simply because no one had seen the animal affected by it. Now it is known, both in this country and in Germany, to be liable to the disease.

The proprietor of the animals referred to in this narrative had the disease communicated to himself. He had never suffered from small-pox nor the vaccine disease; and it was his own spontaneous conviction "*that his cows had been infected from human small pox effluvia*," to which undoubtedly they had been exposed. He had not the remotest idea of the medical theories concerning the nature of the disease, and consequently had no prepossession in favour of the opinion he thus spontaneously expressed. His cattle had hitherto been in good health, and no vaccine variola had been known in the vicinity.

Human small-pox has also been communicated to the cow by direct implantation of the specific virus from man. The efforts at first were numerous and unsatisfactory to inoculate directly the cow with human small-pox; and the experiment is said to have first succeeded at the Veterinary College in Berlin, so early as 1801. M. Viborg, of Copenhagen, about the same period communicated the disease to dogs, apes, and swine. In 1807 Gassner imparted the small-pox to the cow by inoculation. In 1830 or 1831 Dr. Sonderland, of Bremen, communicated the disease to cows, by simply covering the animals with sheets and blankets on which persons suffering from small-pox had lain. In 1836 Dr. Basil Thiele, of Kasan, in South Russia, successfully inoculated some cows on the udder with the *virus* of human small-pox. Vesicles were produced bearing all the characters of the true vaccine vesicle in those animals. The lymph so produced from the *variolation* of the cow continued to retain the specific properties of the vaccine variola throughout seventy-five successive transmissions in the human subject. In 1838 M. Thiele repeated this interesting experiment with a similar success. It would therefore seem that the constitution of the cow has the power of assimilating, of modifying, and of mitigating the human *variola virus*, and of stamping it with the properties of the vaccine variola. Dr. Ceely, of Aylesbury, twice succeeded in accomplishing this object (so important pathologically) after many fruitless trials. The interesting papers by him in the eighth and tenth volumes, and the Reports of the Vaccination Section of the Provincial (now British) Medical Association, in

their *Proceedings* for 1839 and 1842, should be studied by every student of Medicine. The main points of the statement here given are taken from these sources. Very recently (1860) Martin inoculated some variolous matter, taken from a pock upon the body of a man who died of variola, into a cow's udder, and subsequently vaccinated about fifty persons with the matter derived from the cow. Most of those so inoculated were attacked with variola, and three died. (*Boston Med. Jour.*, 1860; *New Syden. Society Year-Book for 1860.*) It would have been better, or at least more judicious, to have chosen a milder case than a fatal one to have inoculated from. Mr. Ceely has also often communicated the vaccine disease from man back to the cow (*retro-vaccination*, as it has been called); and he has observed that good human lymph, when *re-transmitted* in this manner, loses some portion of its activity. The phenomena appear later, smaller vesicles are produced, but ultimately, *after successive re-inoculations on man*, it regains its activity.

As the first origin of these specific poisons is as yet unknown, it cannot be now definitively determined whether man first had the disease communicated to him from the animal creation, or whether the lower animals, such as horses or oxen, had the disease communicated to them from man. The existence of small-pox in man is recorded in China as early as 1,122 years before Christ (MOORE). And it is certain that when variolous disease appears among the lower animals in a malignant form, it is capable of producing, by inoculation, a disease of similar severity in man, if he has not already suffered from a similar affection; and that the direct inoculation of the cow with human small-pox produces a mild and mitigated form of disease—that such disease being again reproduced in man by inoculation from the mitigated disease of the cow, accords entirely in its character, in its progress, and in its protecting influence with the *variola vaccinae*, as described by Dr. Jenner. These and similar facts seem to lead to the conclusion that small-pox and cow-pox are not dissimilar diseases, but are identical in their nature.

There are some remarkable facts which must at once arrest the attention of the student who carefully studies the accounts given of the experiments on men and animals, from which many of these statements are deduced. *First*; There seems to have been great uncertainty and difficulty often attending the actual

attempts to transfer the specific virus of these eruptive or variolous diseases from one animal to another. The very interesting experiments of Ceely, and of Thiele and others, demonstrate this in a remarkable manner. *Second*; These experiments show the *marked improvement which sometimes takes place in the energy, and therefore in the quality of the specific virus, by subsequent removes or inoculations, in animals of the same kind, after the virus had been successfully implanted in one of them.* This energy and improved quality was shown in the more perfect development of vesicles, and in the more active manifestations of the primary and secondary symptoms. The subsequent inoculations of such improved lymph seem to produce less severe and less dangerous *local* results—the virus seems less acrid, less virulent, and less mischievous—having apparently acquired increased specific activity combined with mildness of action, and a greater susceptibility of transmission from one animal to another of the same kind.

Keeping, therefore, these facts in view, the present remarkable epizootic of variolæ ovinæ, which has made its appearance (August, 1862) in some of the largest breeding flocks of sheep in the West of England, is of great interest to the Pathologist. This variolous disease of the sheep allies itself very closely with small-pox in man, with cow-pox amongst cattle, and with the vesicular eruptive diseases of the horse, but undoubtedly modified by the constitution of the sheep, just as the variola of man is known to be modified or transformed by the constitution of the cow into the variolæ vaccinæ of that animal.

The ovine variola is known as the *clavelée* of the French; and although this kind of *rot* was not observed in this country till 1847, when it was imported from Spain, yet it is a disease by no means uncommon as an epizootic in the flocks of Italy, France, and Moravia. In 1803 the mortality was considerable in Moravia; but by a timely inoculation with the *virus* of the disease, the remaining part of affected herds were preserved. The artificially affected animals seemed to pass through a milder disease. To this kind of inoculation the name of "*clavelisation*" has been given, from *clavelée*, the French word for the *tag-sore* or *rot*. This variolous disease in sheep assumes one of two forms, namely, —(1.) A virulent or malignant form; and (2.) A benign form. The virulent form (which would seem to be the form at present

epizootic in England) never produces pustules; and specific virus for safe inoculation (clavelisation) can only be got from the benign form of the disease. When the disease is virulent the sheep lose their eyes, their wool falls off, and their skin cracks in a zig-zag manner. Their nostrils are so full of a foetid discharge that the shepherds are under the necessity of constantly syringing them with medicated lotions, to prevent suffocation. When the disease is benign, genuine pustules form, and every pustule, after the scab falls off, leaves a cicatrix in the form of a pit. On this cicatrix the wool never grows again. Hence it can always be told what sheep have undergone the variolous disease, as easily as it can be seen that a human being has had small-pox.

The prevention or mitigation of this disease among sheep is a most important object in a sanitary point of view.

In 1803 Dr. De Carro, of Vienna, tried the effects of the inoculation of the variolæ vaccinae, but without success. The inoculation only produced small local sores. It is said, also, that this sheep-pox cannot be communicated directly to the cow, nor to children (CEELY, SIMONDS). Other observers state, however, that it is so communicable, and that *ovination* is protective against small-pox (SACCHO). The *ovination*, or inoculation of the disease from sheep to sheep, was first proposed by Chalette in 1762, and has been yearly practised since that time in many parts of Italy, Prussia, Austria, and France. At present the practice of inoculation from sheep to sheep is practised in England by Professor Simonds. Results accrue to sheep from the communication of the disease to them by inoculation, not less beneficial (compared with the fatal effects which followed when they become affected with the disease in the "*natural way*") than the beneficial effects that accrued to man when small-pox was communicated to him by inoculation—as it *rightly* was—before the protective powers of vaccination were known.

The ovine variola has been ascribed by some farmers to the communication of the virus from an eruptive disease of the horse (DE CARRO, RING). Fontan relates that some mares being affected with a pustular eruption, the matter from the pustules was inoculated on the teat of a cow, where it produced several fine pustules. From these several infants were vaccinated, with the result of producing perfectly characteristic vaccine vesicles. Thirty infants have been vaccinated from this source at Tou-

louse, and in all the result has been most satisfactory. (*L'Union Méd.*, 1860; *New Syden. Society Year-Book*, 1860.) If this can be definitively established, then the successful inoculation of some animal, *other than the sheep*, with the virus from the specific eruptive disease of the horse, may give such energy and, at the same time, mildness to the morbid poison by subsequent removes, that the implantation of the new virus (*equination*) may perhaps be followed by the same beneficial results to sheep in respect of the malignant variolous disease to which they are liable, that *vaccination* has conferred on man in respect of small-pox. The question also at once suggests itself: "Has human small-pox ever been communicated to sheep, with the view of obtaining a modified lymph which may confer protection on them from the variolous disease to which they are liable? From analogy, may we not indulge the hope that the practice of inoculating sheep from the small-pox of man might induce as mild and modified a disease in them, and prove as protective to them as vaccine variola, through vaccination, has been to man? Or, having communicated the human variola to cows (as the experiments of CEELY and THIELE demonstrate that such may be effected) might not sheep be tried with the resulting virus as a protective agent? The vesicular eruptive diseases of dogs, as well as of horses, should be similarly inquired into and experimented with, seeing that dogs are so much associated with sheep.

The outbreaks of the variolous diseases amongst cattle and sheep seem to follow similar inexplicable paths to those which small-pox amongst human beings is observed to follow. Occasionally the disease is *epizootic* (equivalent to *epidemic* amongst men), or prevalent at the same time in several farms at no great distance. Cases also spring up like small-pox, now and then, which appear to be solitary, and the source of which cannot be traced. It is rare indeed that the solitary cases of small-pox in human beings can be traced to a communicating source. In oxen it may be seen sometimes at contiguous farms; at other times, one or two farms, apparently similarly circumstanced amidst the prevailing disease, entirely escape its visitation. Sometimes it is introduced into a dairy by recently purchased cows. On the other hand it has been undoubtedly communicated to cows from the vesicular disease of the horse, through the hands of the common attendant on both animals. There can be no doubt,

also, that the disease often exists, although it is not observed; for the disease being mild, and the tempers of the animals good, little notice is taken of tenderness in milking, which is of frequent occurrence, and so the existence of disease escapes detection.

There are also *spurious* forms of the disease, which it is very necessary to be able to distinguish.

In the true cow-pox there is very slight manifestation of fever or constitutional disturbance. The secretion of milk may diminish; but the animal continues to feed and to graze very much as usual. The local affection may be so mild that a single vesicle only may appear upon the udder of the cow; but where the udder is voluminous, flabby, and pendulous, and uncovered with hair, with a corrugated, thin, or fissured skin, then there is apt to be a copious eruption. The disease is very readily propagated from cow to cow by the milkers; and it is also said to be communicated in the natural way.

The local symptoms of the natural disease are evinced by heat and tenderness of the teats and udder for three or four days, followed by irregularity and pimply hardness of the surface, especially about the bases of the teats and the adjoining vicinity of the udder. The pimples assume a red hue when about the size of a vetch or pea, and are quite hard. In three or four days more they increase to the size of a horse bean, milking becomes painful to the animal, and the pimples become vesicles, which are then apt to be broken by the hands of the milkers, giving rise to troublesome and dangerous sores on the udder and teats of the cow, and communicating the disease to the milker if he is not already protected by having had the disease before. If the vesicle remains unbroken it becomes a globular, oval, and ultimately a pointed (acuminated) pustule. A central depression, with a marginal induration, is the form ultimately assumed; and when punctured towards the centre the vesicles yield a more or less viscid amber-coloured fluid. Dark-brown or black, solid, uniform crusts eventually form on the site of the vesicles. Some of these crusts may be seen semi-detached, others entirely so, and exposing a raw surface with a slight central slough. The forms of the crusts are either circular or oval, some flatter, and others unguiform, some thin, and more or less translucent. These varied appearances are seen in all stages at the same time, indicating the formation of new crops of vesicles at different periods. The

period of incubation, after casual communication of the disease, seems to be from six to nine days, although it is said pimples may be felt under the cuticle about the fifth day. When the vesicles are fully mature they may measure from eight to ten lines in the largest diameter; the centre and edges of the intumescent margin being of a deep blue or slate colour, and the surrounding areola of a pale rose-colour, and seldom more than four or five lines in depth, the integuments under it being deeply indurated. The lymph contained in the vesicle is now so copious that the cuticle over the central depression appears raised up by it, and so gives rise to a globular or cone-like vesicle; or it spontaneously ruptures, when the lymph freely flows out, and concretes into a clear amber-coloured crust or scab.

If undisturbed, this crust or scab gradually becomes thicker, darker, and more compact, till the thirteenth or fourteenth day, and spontaneously separates about the twentieth or twenty-third day. A cicatrix or pit is thus left, which is shallow, smooth, oval, or circular, of a pale rose or whitish colour, with some traces of induration surrounding it. The anatomical structure of the vesicle seems to be precisely similar to that of small-pox in man, as shown now by many observers (GENDRIN, CEELY, and others). The cow—like children and the young of other animals, particularly high-bred dogs—is subject also to a purely vesicular eruption, which makes its appearance about the ninth or tenth day of the vaccine disease. The vesicles of this eruption, within twenty-four hours, contain a pellucid serous fluid, raising the epidermis. On the following day they become turbid, the cuticle collapses or bursts; a thin, brittle, flimsy crust forms, and speedily falls off. Successive crops continue to form and desiccate for three or four weeks.

Primary Vaccine Lymph.—To procure *primary* liquid vaccine lymph direct from the cow, in a condition fit for use, is a task of no ordinary difficulty. *Primary* crusts should be sought for on the lower part of the udder and around the base of the teats; and during a search for these it is not improbable that smaller vesicles of later growth may be found to yield efficient lymph. The best lymph is to be obtained from perfect vesicles, before they begin to point. After this period it is less to be depended on, particularly if very abundant, thin, or discoloured. Pointed vesicles, when broken by violence, are rarely to be relied on.

Entire unpointed vesicles, or vesicles with central crusts, should be sought for on parts where they are least exposed to injury—namely, on the lower and naked parts of the udder and adjoining bases of the teats. It is impossible to exercise too much delicacy in the proceeding. The puncture to liberate the lymph should be made with a sharp lancet as *near the centre* of the vesicle as possible; and the epidermis may be gently raised to a moderate extent around the discoloured or most depressed part. Slight pressure with the blade of the lancet, or between the thumb and finger, will enable the operator to charge a few points or capillary tubes with the slowly exuding lymph. Punctures at the elevated and indurated margin of the vesicle are utterly useless. They only give vent to blood. Vesicles on which the central crust has begun to form are the most productive, particularly if the crust be small and the margin of the vesicle be tender, hot, and tumid; and small superficial vesicles are often more yielding than contiguous larger vesicles, which are more deeply seated or confluent.

Useful substitutes for liquid lymph, capable of communicating the vaccine disease, are,—(1.) Amorphous masses of concrete lymph, found upon or in close proximity to broken vesicles. They ought to be colourless, like crystals of white sugar-candy; or of a light amber hue, resembling fragments of barley-sugar. (2.) Central crusts, irregular, rough, and more or less conical, the more transparent and nearer a dark-brown hue the better. (3.) Vesicular crusts or desiccated vesicles. These crusts should be carefully removed by the milkers before they are casually removed or spontaneously fall; and those only of primary formation, which are as it were the mould of a vesicle, of a dark-brown translucent appearance, should be retained. These three dry conditions of the specific vaccine virus may be reduced to a liquid state at any time for use. Glycerine is said to be the best solvent for such solid conditions of the lymph, which ought to be reduced to powder before the glycerine is added. (Collins, *Boston Med. and Surg. Journal*, 1858.)

Vaccination.—It is now (1862) at least sixty-four years since Jenner first promulgated his discovery to the world, that the eruptive vesicular disease which has now been described as occurring on the udders and teats of the cow, and which he named the *cow-pox*, was communicable directly to the human being, and thus conferred protection from the small-pox, so fatal

to man. The operation for thus ingrafting the cow-pox on the human being has been named "VACCINATION." Its discovery still remains one of the most interesting facts in the history of Medical Science. When still an obscure apprentice with a surgeon at Sodbury, near Bristol, Dr. Jenner first caught a glimpse of this great truth, which he thoroughly investigated amongst the expiring embers of that epizootic disease which laid waste the herds of this country towards the end of the last century. He did not suffer the spark to be lost in the flame it had served to kindle. Amongst the gossip of the cow-herds he had heard of the vague, obscure, but popular belief regarding the possible communication of cow-pox to the milkers of the cows, and the protection from small-pox which the cow-pox conferred—a belief which undoubtedly prevailed in the rural districts of Gloucestershire, and, at the same time, curiously enough, on the continent of Europe, in some districts round Göttingen. These things Jenner mentioned to the famous John Hunter, at the time he was an apprentice to that eminent surgeon; but John Hunter, otherwise sagacious and far-sighted, pooh-poohed the notion as vague and improbable. Nevertheless, Jenner had determined to examine into the truth of the tradition; and he commenced his earnest and painstaking investigations as soon as he had established himself as a surgeon at Beakely. In June, 1798, he published his observations in the form of a thin quarto, of scarcely more than seventy pages, dedicating it to his friend, the late celebrated Dr. Parry, of Bath. Jenner seems to have felt almost a holy reliance in the truth of his great discovery; and in the face of much foolish opposition he modestly continued to prosecute his inquiry, "encouraged," as he said, "by the hope of its becoming beneficial to mankind." By his own unceasing and life-long efforts his great discovery was elaborated, and at last fully developed. Its importance to the welfare of the human race has since been clearly demonstrated; and the acute observation of Jenner himself has been abundantly fulfilled, namely, that the keenest of all arguments for, or against, the practice of vaccination will be *those which are engraved with the point of the lancet*. We have, indeed, in this country, paid but tardy homage to his memory; nevertheless, he has imprinted for himself imperishable "footprints on the sands of time," which wave after wave of scientific research appears only to make more distinct. He has

not only pointed out the means of subduing a loathsome disease, but the health of all civilized communities has improved, and in proportion as vaccination has been efficiently carried on, the frequency of epidemics has been diminished, and the duration of human life has been extended.

The subject of vaccination is one which demands a careful study, alike in its pathological and in its sanitary relations. Questions of great national importance are concerned; and the following account is mainly given from a notice of the subject, written by the author, in the pages of the *Medico-Chirurgical Review* for 1857:—

In 1841 the Vaccination Act was passed, which rightly made the practice of *inoculation unlawful*. In 1853 another Act was passed, with the view of rendering the practice of *vaccination compulsory*,—an Act which is known as Lord Lyttleton's Vaccination Act. During the interval between the first and second reading of the Bill in the House of Commons, "The Small-Pox and Vaccination Committee of the Epidemiological Society completed a report on the prevalence and mortality of small-pox, and of the means taken to guard against it through vaccination." The conclusions they arrived at were deduced from the largest and most accurate mass of statistical evidence which had ever been brought to bear upon the question, and were eminently calculated to encourage Her Majesty's Ministers to pass an efficient measure to *compel* vaccination. A most valuable pamphlet was afterwards published by Dr. Seaton, which demonstrates the truth in a still more forcible manner, as to the protecting and modifying influence of vaccination in small-pox. To this belief, indeed, the general assent of the medical profession appears to have been given at least fifty years ago. *Then*, it would seem to have been all but unanimous; and *now*, one would think, at first sight, that it were almost an insult to human understanding to be obliged to collect statistics to *prove* that vaccination confers a large exemption from attacks of small-pox, and almost absolute security against death from that disease. But so it is, and independently of the information which such statistical inquiry is calculated to convey to those who advise our Lawgivers and Public Administrators, the inquiry is eminently useful in relation to everything which bears on the nature of vaccine and variolous disease. The general

ignorance of the community, especially of the lower orders, as to the aim and object of vaccination, is lamentably great, and has still to be overcome. Moreover, the highest medical authorities of late years recommend that all views and facts put forward as objections to vaccination should be vigorously inquired into, and that there should be published from time to time a true account of such inquiries, with an elucidation of what has seemed doubtful and contradictory (SIGMUND, ALISON).

It is now well known that Lord Lyttleton's Vaccination Act (1853) has proved but a very imperfect measure—a piece of legislation which has fallen very far short of accomplishing all that is yet required. The inefficiency and imperfect working of the Act has been fully shown,—(1.) In the Reports of the Registrar-General for 1854; (2.) By the medical profession generally; (3.) By the medical registrars in particular; (4.) By the public, as expressed now and again in the newspapers of the day. To this state of things we owe a most valuable work on vaccination, written by the indefatigable medical officer (JOHN SIMON, F.R.S.) of the then (1857) General Board of Health. The aim of this publication was to lay before the Board such medical facts and considerations as might assist in estimating the hygienic value of vaccination, and the strength of any objections which may have been alleged against its general adoption. This work is especially valuable, because it brings together a body of evidence down to the day of its publication—evidence of a pathological and statistical kind—such evidence as Jenner would have rejoiced to see—records which have been engraved by the lancet's point. But evidence of the inefficiency of the Vaccination Act of 1853 still continues to be apparent, as may be seen from the yearly reports of the medical officer of the Privy Council. During three or four years previous to 1860, Mr. Simon writes, that "Sometimes in one set of places, and sometimes in another, there have been occurring almost generally throughout England, epidemics of small-pox more or less considerable." To such an extent has this been the case, that in 1860 the Lords of Her Majesty's Most Honourable Privy Council deemed it necessary, with reference to local outbreaks of this disease, to enter into correspondence with the authorities responsible for public vaccination in several unions of England where small-pox had been prevalent. Some of these districts were

specially visited by competent medical officers; and in two adjoining Devonshire Unions it was ascertained that the *diffusion of small-pox* had actually been to some extent *wilfully promoted by the illegal practice of INOCULATION!* Alarm was of course justly excited among educated persons in the endangered places, by the knowledge that this offence was being committed; and in one case, where there was reason to believe that *inoculation had been the cause of death*, Secretary Sir George C. Lewis offered a reward of £50, to be paid to any person not actually concerned in the offence, who would give information and evidence leading to a conviction of the offender.

The unsatisfactory working of the Vaccination Act of 1853, now amply proven, has led to the promulgation of an Order of the Privy Council (of date December 1, 1859), for the improvement of public vaccination. Their Lordships have seen fit to direct the commencement of a *systematic inspection* with reference especially to the operation of vaccination, and its efficiency in Unions where the amount of infantine vaccinations, compared with the number of births, appeared to be especially low. These inquiries continue to show that the present law, "to extend and make compulsory the practice of vaccination," is so imperfect as to be almost inoperative; and the *systematic inspections* instituted seem to have been so useful in promoting vaccination that their Lordships propose to continue them throughout all the Unions of England.

The present position of our knowledge regarding vaccination is based upon evidence which demonstrates,—(1.) The *protective influence of vaccination*; and (2.) The causes which have combined to *impair its protective power*. Of these in their order.

I. *Of the Protection conferred by Vaccination—its Nature, and the Evidence of its Existence.*

The main features of the reports and works already mentioned amply illustrate how small-pox diminishes in its mortality *in proportion as* EFFICIENT measures are adopted to insure PERFECT vaccination. To demonstrate this statement, the progress of vaccination in Great Britain and in Germany has been compared as to its influence on mortality generally; and more particularly, it has been shown, by comparing the statistics of vaccination from various German states with similar statistics from different districts in Great Britain and Ireland, that where vaccination is

most perfectly carried out, small-pox is least mortal. The following are the general results which the committee of the Epidemiological Society arrived at:—

1. To prove the influence of vaccination in England, it is shown that out of every 1,000 deaths in the half-century from 1750 to 1800 there were 96 deaths from small-pox; and out of every 1,000 deaths in the half-century from 1800 to 1850 there were only 35 deaths from small-pox.

2. To prove the influence of vaccination on the Continent, it is shown that in various German states sufficient evidence can be obtained to show that out of every 1,000 deaths *before vaccination was used*, 66·5 were deaths from small-pox; but that out of every 1,000 deaths, *after vaccination* came into use, the deaths from small-pox were only 7·26.

3. To prove that in countries where vaccination is most perfectly carried out, small-pox is least mortal, it is shown that—

(a.) In this country, where vaccination has been voluntary, and frequently neglected, the deaths from all causes being 1,000, the deaths from small-pox were as follows:—

London,.....	16	Edinburgh,.....	19·4
Birmingham,.....	16·6	Glasgow,*.....	36
Leeds,.....	17·5	Galway,*.....	35
England and Wales,.....	21·9	Limerick,*.....	41
Perth,.....	25	Dublin,.....	25·6
Paisley,.....	18	Connaught,*.....	60
All Ireland, 49.			

(b.) In other countries where vaccination has been more or less compulsory, the deaths from all causes being 1,000, the deaths from small-pox were as follows:—

Westphalia,.....	6	Bohemia,.....	2
Saxony,.....	8·33	Lombardy,.....	2
Rhenish Provinces,.....	3·7	Venice,.....	2·2
Pomerania,.....	5·25	Sweden,.....	2·7
Lower Austria,.....	6	Bavaria,.....	4

Evidence corroborative of these results has been adduced

* With regard to the high rate of small-pox mortality in the towns marked by the asterisks, it was clearly shown by Dr. Stark, in Edinburgh, and by Dr. J. C. Steele (the present Medical Superintendent of Guy's Hospital in London), that such mortality was due to the neglect of vaccination. Dr. Steele, then resident in Glasgow Infirmary, called attention to the great increase of small-pox in Glasgow, as mainly coming from the Highland and Irish population, among whom vaccination was rare. Dr. Stark showed that more than eighty *per cent.* of all the deaths from small-pox happened in children under *five* years of age.

by Dr. Balfour from the records of the Army and Navy Medical Departments, where every soldier or sailor is protected by vaccination, if he has not previously suffered from *cow-pox* or *small-pox*.

1. For twenty years, namely from 1817 to 1836 inclusive, it is shown that in Dragoon Regiments and Guards, with an aggregate strength during that period of 44,611 men, and a total mortality of 627, only *three* deaths were from small-pox.

2. Among the troops at Gibraltar, the aggregate strength being 44,611 men during that period, and a total mortality of 1,291, only *one* death from small-pox occurred.

3. In the West Indies several epidemics of small-pox prevailed during the period; but there were *no deaths* either among the British or white troops, of whom the aggregate strength was 86,661, and with a total mortality of 6,803. Among the black troops on the same station, with an aggregate strength of 40,934, and a mortality of 1,645, there was not *one* case of small-pox.

4. At Bermuda, Nova Scotia, New Brunswick, Cape of Good Hope, and the Mauritius, not a death from small-pox occurred during the twenty years mentioned; and the white troops of Western Africa wholly escaped this disease, while the black unprotected population were dying by hundreds.

5. In Malta, from 1818 to 1838 inclusive, the aggregate strength of the British troops being 40,826 during these twenty years, and the total mortality 665, only *two* deaths were from small-pox. This is the more remarkable, inasmuch as small-pox raged as an epidemic all over the island in 1830, and again in 1838, destroying 1,169 persons. In 1830 there died of small-pox 1,048, out of a total mortality of 3,407; and in 1838 there were 121 deaths from small-pox, out of a total mortality of 2,583.

The disease was first introduced by His Majesty's ship "*Asia*." The mortality among those "*not vaccinated*" was 1 in 4·7; among those "*supposed to have been vaccinated*" it was 1 in 23·4; and lastly, among those attacked a second time by small-pox the mortality was 1 in 10·8. The native population of Malta in 1830 was estimated at 100,839 persons, amongst whom it appears that 1 in every 12·1 persons was attacked with the disease, and 1 in every 85 persons died. Amongst the military, including wives and children, the proportion attacked was 1 in 188, and the mortality only 1 in 682. Other evidence equally conclusive has been given regarding Bengal by Mr. Bedford, in

the *Indian Annals of Medicine*, and in the Government reports regarding Ceylon.

One very obviously beneficial result of vaccination has not been so much appreciated and noticed as it ought to be—namely, that while the *epidemic influence* of small-pox greatly *increased* during the practice of *inoculation*, it has greatly *diminished* since vaccination has been adopted. Dr. Hebra, of Vienna, alludes to the fact, and incidentally remarks, “That epidemics of small-pox have been more rare, and are less malignant, since the introduction of vaccination. Definite data are to be gathered from the various reports already mentioned, and which fully bear out the belief. The results may be stated as follows:—

1. During ninety-one years previous to *inoculation*, there are on record 65 distinct and well-marked epidemics; which is equal to a ratio of 71·4 epidemics in 100 years.

2. During sixty-three years in which *inoculation* was practised, and that to a very great extent, there were 53 distinct and well-marked epidemics; which is equal to a ratio of 84 epidemics in 100 years.

3. During the fifty-five years since *vaccination* has been mainly practised, there have been twelve distinct and well-marked epidemics of small-pox; which is equal to a ratio of 24 epidemics in 100 years.

This kind of testimony is also greatly enhanced by the fact, that epidemics never occur in the army or navy of our own country, nor in those countries where the soldiers and seamen are efficiently protected by vaccination. The details given with reference to the two Malta epidemics in 1830 and 1838 afford a striking proof of the protective power of vaccination when tested by epidemic influence; and there are records of the Danish army and navy having altogether escaped during several epidemics of small-pox in Denmark.

There is still another way in which the protective power of vaccination makes itself manifest—namely, by *the mildness of the disease in the vaccinated compared with the unvaccinated, and the almost absolute security against death from small-pox which PERFECT vaccination confers*. With few exceptions, this appears to be the universal belief of the medical profession. At various times the opinions of large numbers of medical men have been specially asked for and obtained on this point. *Three*

distinct and very comprehensive "*polls*" may be referred to, namely,—(1.) That by the College of Physicians in London eight years after vaccination had been adopted. (2.) An almost national "*poll*" taken by the Epidemiological Society of London about the years 1852 and 1853. The written opinions of nearly two thousand medical men in this kingdom, as well as Bombay, Bengal, the Mauritius, the West Indies, and various other places, were here expressed; and they concurred in confirming the belief in the protective and modifying influence of vaccination in small-pox. (3.) A very extensive "*poll*," of which a list is published by Mr. Simon, comprehends not only members of the medical profession generally, but also the members of the Medical Department of the Army and Navy, together with the opinions of foreign governments.

These "*polls*" may be held as completely decisive of the question, really practically decided in the affirmative fifty years ago. From such evidence the inference is so inevitable, "that he who disputes it is equally unreasonable as he who opposes in like manner any proposition in Euclid" (ALISON).

The actual *extent of the security against death from small-pox* enjoyed by vaccinated compared with unvaccinated persons, has been calculated by Mr. Simon from various sources; and it appears that the death rate from small-pox amongst the vaccinated varies from an inappreciably small mortality to $12\frac{1}{2}$ *per cent.*; that amongst the unprotected the death rate from small-pox ranges from $14\frac{1}{2}$ to $53\frac{1}{4}$ *per cent.*

The average *per centage* mortality from small-pox, stated by Mr. Marson to occur amongst the vaccinated, is $5\cdot24$; but when vaccination is known to have been perfectly performed, *as shown by the cicatrices*, the mortality is uniformly found to be reduced to less than *half of one per cent.*

Another very important and most interesting phase in which vaccination may be viewed as exercising a protecting influence *indirectly* over the health of the community, may be studied in those statistics which show that the *general death rates from other diseases* have diminished, and more especially as regards *scrofulous diseases*, since vaccination became more universal. To Dr. Greenlaw and to Dr. Farr in this country, and to the Statists of Sweden, we are indebted for any accurate knowledge existing on this subject. Not only has the grand total of the death rates

been diminished, but the death rates of two special classes of diseases have diminished in a remarkable degree. These are,—(1.) Those of the tubercular order of the constitutional diseases—namely, scrofulous affections, including phthisis or pulmonary tuberculosis; and (2.) The continued fevers, especially typhoid fever—diseases belonging to the miasmatic order of the Zymotic class.

Another kind of historical evidence bearing out the protective influence of vaccination is to be seen by comparing the advertisements of old newspapers, especially those during the last portion of the seventeenth and early portion of the eighteenth century, with similar advertisements of the present day. At the former period the ravages of small-pox upon the population were beyond conception, testifying to the wide-spread epidemic influence. The description of every man or woman, as exhibited in “the villanous portraits of the Hue and Cry,” showed them to have been more or less marked with small-pox, or “speckled with *pock-holes*.” Now-a-days it is the exception, and not the rule, to see such pits and scars amongst the population. (*Quarterly Rev.*, July, 1855.)

Thus it is clearly demonstrated how vaccination has thrown the *ægis* of protection over the world; and how ample, how great, and how efficient that protection may be. It has been shown to diminish mortality generally, and the mortality from small-pox in particular, both in civil and in military life, at home and abroad, and just in proportion as it is *efficiently* performed. It has been shown to diminish the epidemic influence; it has been shown to preserve the good looks of the people; it has been shown that it tends to render small-pox a mild disease compared with the same disease in the unprotected; it confers an almost absolute security against death from small-pox; and lastly, it has been shown to exercise a protecting influence over the health of the community generally. On the other hand, it is no less amply proven that “wheresoever vaccination falls into neglect, small-pox tends to become again the same frightful pestilence it was in the days before Jenner’s discovery;—that wheresoever vaccination is universally and properly performed, small-pox tends to be of as little effect as any extinct epidemic of the middle ages” (SIMON). Moreover, it has been clearly shown by the *systematic inspections* instituted by Her Majesty’s Privy

Council, under the direction of Mr. Simon, that it is hopeless to expect to be free from fatal epidemics of small-pox, of greater or less extent, so long as unvaccinated children are allowed to accumulate as they have been found to do. There is therefore the greatest necessity for vigilance on the part of every intelligent member of the community to prevent any re-accumulation of neglect and of unvaccinated persons.

Four conditions are absolutely necessary to be efficiently carried out before we can hope to see small-pox eradicated through vaccination, and the aim of Jenner accomplished. These are,—(1.) The vaccination of every child must be made compulsory within a certain time after birth. (2.) *Systematic inspections* of two kinds must be constantly and periodically made by competent persons—namely, one to ascertain as to the effectual performance of the operation, as evinced by the kind of cicatrix visible. This inspection may be most conveniently made in public and private schools. Another inspection should have for its object to ascertain the numbers vaccinated within a certain territory compared with the numbers born in the same place. (3.) Every attempt at *variolous inoculation* ought to be made a penal offence. (4.) Every case of small-pox ought to be treated in strict seclusion, and be as completely as possible isolated, following out all the directions given with reference to the management of epidemics at page 219, as are applicable to the case. A quarantine regulation to enforce segregation of the sick from small-pox is of far more importance in this country than for yellow fever, which does not find a habitat with us. We come now to consider—

II. *How the Protective Influence of Vaccination has been Impaired.*

Since vaccination has been generally practised it has now and then seemed apparent that “the *protective power of vaccination becomes gradually weaker, and at length dies out in the individual.*” The works and reports which have been mentioned seem to demonstrate the truth of this statement; but in justice to Dr. Seaton (one of the greatest authorities on the subject) it must be stated that he does not subscribe to this belief. Indeed, in his last report (*Appendix to Public Health Report for 1861*, p. 64), he states that where uniform care in the selection of lymph, and in the performance of the operation was practised, the results

did not favour the hypothesis that there had been any necessary deterioration of the lymph. He has seen several cicatrices, the results of the vaccinations of Dr. Jenner and Dr. Walker; but the work of the vaccinators to whom he refers (and mentions as having bestowed great care in the selection of their lymph and in the performance of the operation) will bear comparison with the results obtained by Dr. Jenner and Dr. Walker.

In 1809 Mr. Brown, of Musselburgh, in Scotland, near Edinburgh, published the opinion that the prophylactic virtue of cow-pox diminished as the time from vaccination increased. In 1818 and 1819 small-pox prevailed in Scotland as an epidemic, and many vaccinated persons passed through a mild form of variola. The terms "modified small-pox" and "varioid disease" about this time came into general use, and two classic monographs on the subject made their appearance, one by Dr. Monro, in 1818, and another by Dr. John Thomson, of Edinburgh, in 1820. Dr. Copland also writes that he saw and described, as early as 1823, small-pox as it affected members of the same family at different periods after vaccination, and in young persons who had been vaccinated only ten or eleven years. Contrasting such cases, he found that the severity and fully developed condition of small-pox was generally in proportion to the length of time which had elapsed from vaccination. (*Dictionary of Practical Medicine*, Art., "Small-pox," p. 815.)

Again, from the evidence contained in the bills of mortality of 1825—from the experience of epidemics of small-pox in France and Italy, in 1826, 1827, and 1829—from the experience of the epidemics of small-pox in Ceylon in 1833 and 1834—and from the admissions into the London Small-pox Hospital in 1838, it has been rendered obvious that the susceptibility to small-pox, which in vaccinated persons is destroyed for some years, returns with advancing age, and becomes greater as life advances.

Some of the phenomena, also, which the practice of vaccination itself has made known to us tends to establish the doctrine of a gradual impairment of vaccine protection, due to *lapse of time*, and as a result of *physiological changes in the healthy body*. This is especially indicated by the fact, that in proportion (undetermined) to the distance of time that has elapsed from the first implanting of the vaccine virus, so is the better development of the vaccine vesicle produced by re-vaccination. It has been

shown, however, from a careful analysis of cases, that the lesser protectedness of certain vaccinated persons bears at least *some* proportion to the number of years which had elapsed since vaccination. Any *uniform* rate of increased susceptibility to small-pox from year to year from the period of vaccination has not been demonstrated; but an increasing susceptibility to small-pox continues up to about thirty years of age at least, after which period of life it seems that the liability to contract small-pox continues to decline (HEIM, MOHL, RETZIUS, MARSON, SIMON.)

Dr. Balfour, of the Army Medical Department, adverted some time ago to these important facts; and there can be no doubt of the practical result to which they point—namely, re-vaccination, as a most necessary supplemental measure to vaccination. A large reduction in mortality, and in the occurrence of small-pox, can be shown to have taken place from the practice of *re-vaccination* as to leave no doubt of its practical efficacy. The records of the earliest experience of its usefulness dates from Wirtemberg, 1829 to 1836. In 1833, between forty and fifty thousand adults were *re-vaccinated* in the Prussian army, and in about 33 per cent. of the entire number this *re-vaccination* “took” with perfect success. Amongst Russian soldiers at Kasan, the rate of perfect success was about 18 per cent. In the army of Denmark, from 1843 to 1847, nearly 20,000 *re-vaccinations* were practised, of which more than a half were attended with *perfect* success, and more than a quarter with *modified* success. Since 1843 *re-vaccination* has been compulsory in the Bavarian army. From that date till 1857 not even a single case of unmodified small-pox has occurred, nor a single death from small-pox. Similar good results have followed the institution of re-vaccination in the Danish army, the army of Sweden, of Baden, and in the British army, also, according to Dr. Balfour’s interesting report for 1858 and 1859. So great, indeed, is the practical importance of *re-vaccination*, that in the British army a departmental order was issued by circular, of date 21st September, 1858, and is at present in force, which ordains that “every recruit, without exception, on joining the Head-Quarters, or Depot of the Corps or Regiment to which he belongs, shall be vaccinated, even if he should be found to have marks of small-pox or of previous vaccination, and that a monthly return of the

results (as to (1.) a perfect vaccine pustule following the operation, or (2.) a modified one, or (3.) a failure) shall be forwarded to the Director-General." (*Statistical Report for 1859*, p. 21.)

On the other hand, it must also be remembered, as Mr. Marson clearly shows, that "probably *re-vaccination* does not afford the same amount of protection that the first vaccination *well performed* does. The great object to aim at is to vaccinate *well* in infancy. This should be looked upon as the sheet anchor; and therefore a careless vaccination should be deprecated at all times, practised under the belief that, if it fails to take effect properly, it will be of no consequence, as the operation can be repeated. By such a proceeding the vaccination often takes effect *badly*, and will never afterwards take effect *properly*, and yet the individual may take small-pox *severely*."

It has been alleged (but sufficient proof has not yet been adduced to show) *that the vaccine virus becomes deteriorated by its passage through numerous human bodies*. In other words, it has been supposed that its protective influence is weakened by length of time or of use, in consequence of the long succession of subjects through whom it has been transmitted, since its direct inoculation from the cow. This doctrine is opposed to the obvious pathological fact, that the specific virus of cow-pox, small-pox, and other similar diseases multiplies and reproduces itself in the system of those who suffer in the natural course of these diseases. Considerable differences of theoretical opinion prevail upon the point. The National Vaccine Establishment state, in the report for 1854, "that the vaccine lymph does not lose any of its prophylactic power by a continued transit through successive subjects." Such an unqualified belief is not, however, by any means universal, as shown in various parts of the evidence collected by Mr. Simon. It is certain that the vaccine lymph, when taken direct from the cow, seems to show an amount of infective power which is not usual in lymph of long descent; but how much of this effect is due to irritation simply, and how much to specific action, does not seem certain. Lymph direct from the cow "takes" (as the phrase is) in persons with whom lymph of long descent has failed. This is more often obvious in re-vaccinations. Lymph direct from the cow excites local changes of an intenser kind, so active, indeed, as to render caution necessary in its selection and use. The vesicle produced by it runs a full

course, compared with which, the progress of vaccine vesicles from lymph of long descent seems unduly rapid, and their termination premature. Also, the lymph direct from the cow renders more certain, and apparently more characteristic, that slight febrile disturbance which is proper to the action of cow-pox on the human system. This febrile disturbance is undoubtedly an essential pathological phenomenon, demanded alike for the due protection of the vaccinated person, and for the perfect development and local multiplication of laudable and efficient lymph, at the spot where the specific vaccine virus was originally implanted. The more distinctly and typically the specific febrile action is expressed which follows the implanting of the vaccine virus, the more certainly is the person protected, and the more efficient is the local development of the lymph which has been multiplied at the site of inoculation. The development of any other febrile state, such as from cold, or other disease, is apt to hinder the development and progress of the vaccine vesicle altogether. Referring to the records of re-vaccination in the Prussian army, an extremely interesting fact is brought out by Mr. Simon, tending to confirm the doctrine that, by transmission through a succession of persons, the vaccine virus has degenerated—namely, “*that the re-vaccinations of 1836, as tested by eventual resusceptibility to cow-pox, were not half so stable as the vaccinations of 1813.*”

On the whole, therefore, there appears to be still room to believe that any diminution of protective influence from vaccination may be due to personal carelessness—first, in the *selection* of lymph for use, as well direct from the cow as of lymph of long descent; and secondly, in the choice of cases to continue the vaccinations from—cases, for example, being chosen where the lymph of the local vesicle at the site of vaccination has been developed in the absence of the constitutional specific febrile phenomena; and in which the lymph contents of the vesicle are not only impotent, but the anatomical development and structure of the vesicle in respect of its dissepiments are at the same time incomplete and imperfect. The cicatrix scar, or mark left by imperfect vaccination, is also an imperfect cicatrix, and is capable of recognition as such. To an almost incalculable extent, the *protective powers* of vaccination has been impaired by imperfect vaccination, as shown by Mr. Marson; a fact which does

not seem to be duly appreciated as yet, either by the Medical Profession or by the Public.

The Operation of Vaccination ought to be performed in childhood, and it is ordained by law in this country to be performed within *three*, or in case of orphanage, within *four months* of birth. The infant ought to be, at least, from *four to six weeks* old before a disease, sometimes attended with considerable febrile disturbance, is engrafted upon the constitution. Under *six weeks* of age, infants should never be vaccinated, unless in cases of urgent necessity, such as small-pox being in the vicinity. The age of *three months* is on the whole to be preferred; and the child ought to be in good health, and free from any eruptive cutaneous disease, and free from the disorders of teething and of the bowels, or other diseases peculiar to the age of childhood, otherwise the protective influence of the vaccination cannot be depended on.

Difference of opinion exists as to the number of vesicles it is proper to graft upon the arm, and the size of them. Some believe the person to be as thoroughly protected by a small vesicle, "the tenth of an inch in diameter, as if the arm were covered with inoculated points" (CAZENAVE, ANDREW ANDERSON); and many vaccinators regard the multiplication of vesicles only as a safeguard against failure, and attach value to *one* successful insertion only of the vaccine lymph. (BUCHANAN, *Appendix to Fourth Report on Public Health for 1861*, p. 111.) On the other hand, the official instructions issued to vaccinators in England contain the following directions:—"In all ordinary vaccinations, vaccinate by *four or five separate punctures*, so as to produce *four or five separate good sized vesicles*; or if you vaccinate otherwise than by separate punctures" (for some vaccinators prefer to make long scratches, side by side or intersectingly, instead of punctures) "take special care to secure the production of *four or five separate good sized vesicles*." This is considered necessary for securing to those who are vaccinated the full amount of protection which good vaccination confers. The superior value of several vesicles is especially insisted upon by Marson, Seaton, and Simon. They have shown a constant relation to subsist between the *number* of the sufficient cicatrices and the degree of protection afforded.

The skin covering the insertion of the deltoid muscle is the

place generally chosen for implanting the specific lymph of *variola vaccinae*.

1. The part of the arm to be operated upon should be grasped with the left hand, and the thumb of that hand should draw the skin with sufficient tightness, so as to facilitate the introduction of the point of a lancet with the other hand. Three or four punctures should be made near each other, for each intended vesicle. These punctures should penetrate the cuticle to the extent of a few lines in an oblique direction, so as to make a minute valvular aperture, and so as to impinge upon or penetrate the *cutis vera*. The lancet used to make the punctures should be charged with the vaccine *virus*. It should be allowed to remain in the punctures for *several seconds*, and, *in the course of its removal the site of puncture should be compressed for a moment or so*, to prevent bleeding, and also to retain the virus from the lancet's point. In the case of several punctures, it is advisable to use "*points*" of ivory or quill, or of the teeth of a comb, charged with the virus. These should, on the withdrawal of the lancet, be inserted into the punctures, and allowed to remain for several seconds, to be removed in the same way as that in which the lancet charged with the virus is removed.

2. Another method of operation is often chosen, namely, to make an immense number of minute scratches over a very limited area of skin, and as close together as possible. In this way the number of groups of scratches will correspond to the number of vesicles intended to be engrafted. The scratches may be made with the point of a clean lancet, and may be either parallel to each other or crossed in two or any number of directions. The number of these groups of scratches will vary according as three, four, five, or more vesicles are considered necessary, and the length of the individual scratches will determine the size of the resulting vesicle, and, to some degree, the soreness of the arm. It is necessary to remember these facts in dealing with young and delicate children, so as not to give rise to unnecessary suffering, torment, and danger. The scratches should be so slight as barely to result in the faintest possible exudation of blood, and that only after the lapse of a second or two. To the group of scratches from which blood first exudes, the "*point*" or lancet is to be applied, charged with the specific *virus*. The lymph containing this *virus* will be at once absorbed; and the blood with which the

lymph is mixed should be smeared over and pressed into the other scratches in succession several times.

3. Simple abrasion of the cuticle is also sometimes resorted to with very good success—namely, by scraping off the cuticle with the lancet, used as an eraser is used to remove blots from paper. (*Fourth Report on Public Health*, p. 107.)

Signs of Successful Vaccination.—By the end of the second day small spots appear elevated over the sites of the punctures, or over the groups of scratches or abrasions; and these, when examined by a simple lens, are seen to be vesicular, and surrounded by a slight redness. This stage continues for three to four days from the date of ingrafting the virus. About the *third*, but rather towards the *fourth* day, the elevation is more perceptible and more red; and by the *fifth* or *sixth* day a distinct vesicle is obvious upon it, of a whitish colour, having a round or oval form, an elevated edge, and a depressed centre. Late on the *seventh*, or early on the *eighth* day, an inflamed ring or areola begins to form round the base of the vesicle, and with it continues to increase during the two following days. This areola is of a circular form, and its diameter extends from one to three inches. *On the eighth day the vesicle appears distended with a clear lymph. This is the day of its greatest perfection, and it is the proper period for obtaining the specific virus for continuing vaccination on others. The vesicle is now circular and pearl-coloured, its margin is turgid, firm, shining, and wheel-shaped.*

Having reached its height on the *ninth* or *tenth* day, the development of the bright red areola is accompanied with considerable tumefaction of the skin, with hardness and swelling of the subjacent areolar tissue. This erythematous ring is often the seat of small vesicles. By the tenth day, also, the febrile symptoms of constitutional disturbance are well expressed, the lymphatics of the arm are engorged, and sometimes a roseolous rash supervenes over the body. On the tenth or eleventh day the areola begins to subside, leaving, as it fades, two or three concentric circles of redness. The vesicle now begins to dry in the centre, and acquires there a brownish colour. The lymph which remains becomes opaque and gradually concretes, desiccation commences, tumefaction subsides, so that by the fourteenth or fifteenth day the vesicle is converted into a hard round scab of a reddish-brown colour. This scab contracts, dries, blackens, and

about the twenty-first to the twenty-fifth day from the date of vaccination, may fall off. It leaves a cicatrix which commonly is permanent in after-life. Indeed, the mark of a good cicatrix is indelible if it is not injured (GREGORY, MARSON, CEELY, CAZENAVE, SIMON).

While these local changes are in active progress, febrile phenomena become established—first, so slightly from the fifth to the seventh day, that often the fact passes unobserved; and again, more considerably during those days when the areola is about its height. The patient is then restless and hot, with more or less disturbance of stomach and bowels. About the same time, especially if the weather be hot, children of full habit not unfrequently show on the extremities, and less copiously on the trunk, a lichenous, roseolar, or vesicular eruption, which commonly continues for about a week. When vaccination is performed on such adults or adolescents as have not previously been vaccinated, and likewise when lymph is employed which has recently been derived from the cow, the resulting phenomena, as compared with the preceding description, are somewhat retarded in their course; and the areola is apt to be much more diffuse. There is also more feverishness, and eruption is less frequently seen. (SIMON, *Health Report*, 1859).

Signs of Successful Re-vaccination.—When persons who have once been efficiently vaccinated are, some years afterwards, re-vaccinated with effective lymph, there sometimes results vesicles which, as regards their course and that of the attendant areolæ, cannot be distinguished from the perfect results of primary vaccination. But far more usually the results are more or less modified by the influence of such previous vaccination. Often no true vesicles form, but merely papular elevations surrounded by areola; and these results having attained their maximum on or before the fifth day, afterwards quickly decline. Or, if vesicles form, their shape is apt to vary from that of the regular vesicle, and their course to be more rapid, so that their maturity is reached on or before the sixth day, their areolæ decline on or before the eighth day, and their scabbing begins correspondingly early. In either case the areolæ tend to diffuse themselves more widely and less regularly, and with more affection of the areolar membrane, than in primary vaccination; and the local changes are accompanied by much itching, often by some irrita-

tion of the axillary glands, and in some cases on the fourth or fifth day by considerable febrile disturbance (SIMON, l. c.)

Characters of the Cicatrix after Vaccination.—It seems now to have been agreed to arrange the characters of cicatrices after vaccination into the following *three* classes :—

1. "*Typical*," "*excellent*," "*perfect*," "*good*," or "*first-rate*" cicatrices are recognized by their circular form, and pale or white appearance. They are somewhat depressed, and dotted, indented, or foveolated with minute pits or depressions over the base, supposed to indicate the number of compartments in the anatomical structure of the vesicle (referred to at pages 229 and 267). In some instances there are radiations from the centre. It has been considered that the normal diameter of a cicatrix produced by a single insertion is *one-third* of an inch; that scars of larger measurement are generally of double or multiple origin.

2. "*Fair*," "*passable*," or "*modified*" cicatrices possess the characters of the typical cicatrix, but they are less perfectly expressed, the contour being less regular, and the size being just *within* the average above mentioned. To irregularity of contour, however, it must be remembered that scars resulting from single insertions (as in the ordinary method of puncture), are notably uniform, so that irregularity of contour, when associated with a single puncture for vaccination, indicates that the progress of the vesicle has been irregular; but where the scar results from several contiguous insertions or scratches, no such inference can be made.

3. "*Bad*" cicatrices, which must be held as denoting "failures," are such scars as cannot be recognized as the product of vaccination, by any circumstance beyond being found near the usual site of the operation. Scars also having a less diameter than a *quarter* of an inch ought to find a place amongst this class; and generally all ill-defined, faint, scarcely discernible white patches, especially such as consist of large, flat, ill-defined shiny marks. Fruitless attempts at vaccination may be also recognized by the permanent traces left of the parallel or transverse scratches employed at the operation.

It is, however, very difficult to describe the extent of differences between the results produced by different vaccinators. A large amount of *bad*, and a still larger amount of *second-rate* vaccination has been found to prevail in many districts, as the result of

the inspections instituted by Mr. Simon in 1860 and 1861 abundantly testify. Medical men also are found to vary exceedingly in their estimate of a satisfactory vaccine vesicle and cicatrix or the reverse, for the standard is comparative rather than absolute (SEATON, SANDERSON, BUCHANAN). This is exactly what might have been expected, seeing that medical students are left to pick up their knowledge of vaccination where they can. In fact, practical medical education at our schools of medicine has hitherto, or until very recently, been entirely *nil* in regard to this most important subject; and no test of knowledge has ever been applied. Many men whose estimate of the quality of the resulting cicatrices are of a low standard, can scarcely appreciate the typical character of marks which are the ordinary results of good vaccination (SEATON). Excessively small cicatrices are apt not to be perfect, and there are great varieties in the size of cicatrices, of perfect character, the results of puncture. It is therefore fairly presumed that cicatrices which thus vary cannot all have precisely the same value. The hand of different vaccinators can even be recognized by the kind of marks they leave behind them. The marks of some vaccinators are conspicuous for their excellence; the marks left by others are not so; and hence there are great differences between the vaccination of districts where different vaccinators are employed. In the schools, for instance, of large towns, Mr. Seaton informs us that "where the work of many vaccinators was seen together, it was frequently possible to fit the work to the vaccinator by the kind of cicatrix."

With regard to the means of estimating the efficiency of vaccination, it seems established that "*a distinct connection subsists between the NUMBER and the QUALITY of the cicatrices and the protection conferred by vaccination against small-pox; so that it may be confidently stated that that vaccination is the most efficient from which the most and the best cicatrices result.*" The evidence derived from the records of the Small-pox Hospital collected by Mr. Marson, regarding the superior value of several rather than few vesicles, appears to be conclusive on this point.

These facts have been tabulated by Mr. Simon in the following form, as the result of observations made during twenty-five years, in nearly 6,000 cases of small-pox contracted after vaccina-

tion, the persons having been vaccinated in different ways as regards the *number* and *quality* of the cicatrices:—

Cases of Small-Pox Classified according to the Vaccination Marks or Cicatrices borne by each Patient respectively.		Number of DEATHS <i>per cent.</i> in each Class respectively.
CLASS I.	Stated to have been vaccinated, but having NO cicatrix,.....	21 $\frac{3}{4}$
„	II. Having ONE vaccine cicatrix,*....	7 $\frac{1}{4}$
„	III. Having TWO vaccine cicatrices,†..	4 $\frac{1}{8}$
„	IV. Having THREE vaccine cicatrices,	1 $\frac{3}{4}$
„	V. Having FOUR OR MORE vaccine cicatrices,.....	$\frac{3}{4}$
UNVACCINATED,.....		35 $\frac{1}{2}$

Looking, therefore, to the characters or quality of the cicatrices, and to the number of the vesicles which, having existed, have given rise to these cicatrices, FOUR DEGREES of protection conferred by vaccination may be specified, and the community inspected may be thus arranged into the following FOUR classes:—

CLASS I. Best protected—having *more* than *two* TYPICAL marks.

CLASS II. Sufficiently well protected—having *two* TYPICAL marks.

CLASS III. Moderately protected—having *two* or *more* PASSABLE, or *one* TYPICAL mark.

CLASS IV. Badly protected—having BAD marks, or having only *one* PASSABLE mark.

Selection of Lymph for Vaccination.—The lymph used for vaccination ought to be taken from the vesicle on the EIGHTH day—the *day-week after the operation*—when the lymph is yet clear and the vesicle turgid, firm, shining, pearl-coloured, and translucent, and before the vascular zone has reached its full development. The lymph ought not to be taken from any but perfectly

* Among cases in which the one cicatrix was *well marked* or *typical* the death rate was 4 $\frac{1}{4}$. Among cases in which it was *badly* marked the death rate was 12.

† Among cases in which the two cicatrices were *well marked* the death rate was 2 $\frac{1}{4}$. Among cases in which they were *badly* marked it was 7 $\frac{1}{4}$.

"*typical*" vesicles. Inferior, or merely passable vesicles, ought not to be used to propagate lymph. Small vesicles, exhausted vesicles, or vesicles far advanced (such as tenth or twelfth day) are to be avoided. Very early lymph appears, as a rule, to give the worst cicatrices. Thus "the careful vaccinator does not indifferently vaccinate from the arms of all infants brought back on the *eighth* day, but exercises selection among them." The fresh lymph from the vesicle ought to be ingrafted *directly* upon the arm of the child about to be vaccinated—"arm-to-arm" vaccination, as it is called. Dry, or otherwise preserved lymph ought only to be used when fresh lymph cannot possibly be obtained. Properly dried lymph, however, seems capable of producing quite as good results as arm-to-arm vaccination; but it demands incomparably more care than it generally receives, first in its storage and afterwards in its use. It may be dried and stored on "points" of ivory or bone, or upon small pieces of glass glued together by the dried lymph, or on lancets. These should be well charged—*i.e.*, coated twice, or even thrice, with the lymph, and rolled up in a covering of goldbeater's skin, and still farther secured from atmospheric influences by an outer case of tinfoil hermetically sealed, or in a phial carefully corked, in which they may be packed with cotton, if they require to be transmitted to any distance. Glycerine has been used with success to keep the lymph liquid.

By proper care complete and perfect vaccination may be attained under every variety of method; but bad vaccination, as it prevails at present, is almost always "directly dependent on the careless employment of improperly preserved *dry* lymph, and indirectly associated with irregularity of inspection, in consequence of which the vaccinator remains unaware of the number and extent of his *failures*, and loses all the advantages of experience. "The use of the capillary tubes of Dr. Husband affords considerable advantages to the public vaccinator, especially if his district be rural—*Firstly*, Because it furnishes him with an efficient means of maintaining his supply without having recourse to extraneous sources, and thus enables him to dispense altogether with the use of 'points,' 'glasses,' &c.; *Secondly*, Because in thinly populated neighbourhoods, in which experience shows that it is impossible to assemble all the children at any particular station, it enables him with equal advantage to vaccinate from house to

house." (Sanderson in *Public Health Report*, 1861.) For a detailed account of Dr. Husband's method of preserving lymph, the reader is referred to the *Second Report of the Medical Officer of the Privy Council*, 1859.

CHICKEN-POX—*Varicella*.

Definition.—*The disease consists of a specific eruption, attended with fever, which runs a definite course in eight or ten days.*

Pathology.—This disease derives an importance which it does not of itself possess, in consequence of its resemblance to small-pox, with the modified form of which it is considered by some to be identical. It is for the most part peculiar to childhood and early adult age; but its epidemic influence is very inconsiderable, and its extension easily under control. That it is communicable has been proved by inoculation. The theory of the disease, therefore, is, that a specific poison, after a given period of latency, gives rise to primary fever, which lasts from twenty-four to seventy-two hours, when the eruption appears and runs a course of eight or ten days. The fever is much mitigated on the appearance of the eruption, and entirely subsides with it.

That fever precedes the eruption is a phenomenon observed so generally that no exception is to be found in the account given of the disease by any writer excepting Heberden. The febrile affection is of a mild character, and though for a few hours it may seem severe, yet, perhaps, it never passes into a stage so severe as to have the tongue of a brown and coated appearance. The eruption has three stages,—that of pimple, of vesicle, and of incrustation; and after the fever has lasted from twenty-four to seventy-two hours, a number of red papulæ appear, which become vesicular, and perhaps in a few points pustular, on the first day. On the second day the vesicles are filled with a whitish or straw-coloured lymph. On the third and fourth days they attain their greatest magnitude, when they become *acuminated*, and shortly afterwards they burst and shrivel, except those which contain purulent matter, and have much inflammation around their base. The fifth day they begin to crust, and in four or five days more the crust falls off, leaving for a time red spots on the skin, generally without, but sometimes with, a "pit" or depression. The "pit" is permanent, and the cicatrix generally whiter than

the original tissue, and the patient consequently is marked or scarred. The eruption is not at first universal over the body, but usually consists of a series of crops, which succeed each other at intervals of twenty-four hours, and die away in the order of their occurrence. The first crop usually appears on the breast and back, and afterwards on the face and extremities. The number of crops may be limited to two or three, while in other cases a new succession will appear every twenty-four hours for ten or twelve days.

Symptoms.—On the varicella there are three forms, the *varicella lenticularis*, the *varicella conoides*, and the *varicella globata*. The symptoms of these varieties are similar to each other, their only differences consisting in the size and form of the vesicle—that of the *varicella globata* being the largest.

The fever which precedes this eruption is often as severe as that which precedes mild small-pox or measles, but it generally, though not constantly, remits on the appearance of the eruption, and does not return as the eruption approaches maturity. The urine, however, is usually little affected in the early stages, when it is often as limpid as in hysteria; but when the fever runs high, it assumes the usual febrile characters (PARKES).

The globate chicken-pox is also known as the *swine-pox*, or, vulgarly, "*the hives*." The eruption consists of large vesicles not quite circular in form, but often a little larger than the pustules of small-pox, surrounded with a red margin, and containing a transparent fluid, which, on the second day of the eruption, resembles milk whey. On the third day they subside, shrivel, and present a yellow tint. Before the conclusion of the fourth day they are converted into thin blackish scabs, which dry, and fall off in four or five days more.

Diagnosis.—Dr. John Thomson, who carefully studied this disease during the epidemics of 1815 to 1821, concluded that it was impossible to distinguish chicken-pox from modified small-pox; and as their identity is still a matter of opinion, the following statements (CRAIGIE) embrace the most important pathognomonic characters derived from the respective phenomena of both diseases:—

1. Chicken-pox emits a peculiar odour different from that of small-pox, and less decidedly partaking of the variolous fœtor.
2. Chicken-pox appears indiscriminately, and almost equally all over

the person, beginning first on the trunk in general, and then appearing on the face and scalp; while small-pox appears first on the face and neck, and the pimples are more numerous in the face than in any other part.

3. Chicken-pox eruption is generally completed in the space of twenty-four hours, or solitary vesicles come out irregularly afterwards in different points; but in small-pox the eruption begins in the evening of the third, or morning of the fourth day, and proceeds regularly for the ensuing three days, until it is completely established.

4. While variolous pustules are on the first and second day of the eruption small, hard, globular, red, and painful, and communicate to the finger a sensation similar to that which would be excited by the presence of small round seeds under the cuticle;—in chicken-pox, every vesicle almost has on the first day a hard red margin, but communicates to the finger a sensation like that from a rounded seed flattened by pressure.

5. On the second or third day of the eruption of chicken-pox, the individual bodies are vesicles containing serous fluid, and giving them a whitish aspect.

6. These vesicles are surrounded by little or no inflammatory redness, and do not naturally and independent of external violence, proceed to suppuration.

7. Chicken-pox may be confidently distinguished from small-pox on the third and fourth days by the state of the vesicles, some of which being left entire are shrivelled and wrinkled, while others, whose ruptured tops have been closed by incrustation of their fluid, are marked by radiating furrows. None present depressions on the *apices*; and as they do not suppurate, they incrust and disappear sooner than variolous pustules.

8. The marks left by chicken-pox, when they do leave marks, present a peculiar conformation, being round or elliptical, and less frequently irregular than those of small-pox, and in general smooth and shining. Lastly; it is said by Luders, that while small-pox is formed in the *cutis vera* or corion, the chicken-pox eruption is formed in the tissue situate between the corion and cuticle. (CRAIGIE, vol. i., p. 614.)

Treatment.—It consists simply in abstinence from animal food. having recourse to a milk diet, and careful attention to the bowels. The patient is to be kept cool, by light coverings, and by making him repose on a mattress rather than on a feather bed.

MILIARY FEVER—*Miliaria*.

Definition.—*A disease in which there is an eruption of innumerable minute pimples, with white summits, occurring in successive crops upon the skin of the trunk and extremities, preceded and accompanied with fever, anxietas, oppression of respiration, copious sweats of a rank, sour, fetid odour, peculiar to the disease. The base of the pimples and the skin around are red and irritable.*

Pathology.—As to the specific nature of this disease pathologists are not agreed at the present day. All physicians are not disposed to admit that in *miliaria* a peculiar specific disease exists, with a characteristic eruption and definite course, such as the variolous pustules and course of small-pox exhibit. Certain it is, however, that a peculiar epidemic disease prevailed in different parts of Europe at different periods in the world's history, the nature of which is described in the definition; and although in this country it seems to have disappeared, yet there can be no doubt that a specific disease of this description prevails epidemically in many parts of continental Europe and Asia. The disease of these epidemics has been described under the various names of "sweating sickness," "miliary fever," "sudatoria," "miliaria," and the like. Rayer has given the most accurate account of the disease; and I had an opportunity of witnessing a great number of cases of it amongst the Turks, in their military hospitals at Scutari, during the war against Russia in 1854-1856. The temperature and physical climate of that place, combined with the relaxed habits of the Turks, appear to be favourable to the development of such a disease. The best accounts of it are those of Borsieri and Rayer.

Symptoms.—The fever which precedes the eruption is ushered in by chills, intense and general, shivering, anxietas, oppression of the chest, restlessness, a sense of great feebleness and imminent fainting, with pains in the head, loins, and limbs. In a few hours, nausea, flushing, and profuse sweating supervene, but without any diminution of the dyspnoea, the anxietas or pectoral oppression, but rather with an aggravation, in the form of short, irregular, panting and sighing breathing, as if proceeding from a sense of weight under the sternum, with a feeling of internal heat, wandering pains, and sometimes cramps of the hands and calves of the legs. The pulse is generally rapid, small, and feeble, in a

few cases hard, often variable, irregular, or intermittent at every ninth, twelfth, or sixteenth beat. The tongue is coated with a white, foul, or yellow fur, indicative of a sluggish condition of the alimentary canal; and the bowels are constipated throughout the disease. The sweat which accompanies this febrile state is profuse, and emits a peculiar smell of a rank, sour, fetid odour. From the fifth or sixth day, up to the twenty-first, an itching sensation is felt in the mammary and epigastric regions, and inner surface of the arms, and the skin of those parts is found to be diffusely red, rough, and irregular, with numerous elevations not larger than pin-heads. In a short time the summits of these become pearly-white, the cuticle being elevated by a slight opaque sero-albuminous fluid,—crop after crop breaks out and continues from three to seven days, followed by a corresponding desquamation of the cuticle. This eruption is generally confined to the neck, breast, mammary and epigastric regions, and the inner surface of the loins and legs. In severe cases miliary vesicles appear at the junctions of the skin and mucous membranes, and there they are apt to become apthous.

A deranged state of the gastro-enteric mucous membrane, indicated by nausea and vomiting of bilious matter, acid eructations, flatulence, and diarrhoea, frequently complicate the disease. Two forms have been described,—namely, a mild and malignant. The malignant is rendered so chiefly by the occurrence of violent inflammation in some of the internal organs, especially of the stomach, lungs, kidneys, or brain; and the danger of the disease is chiefly due to these complications. Such malignant forms have been known to prove fatal in two or three days, but more frequently in from seven to twenty-one.

The Treatment of the disease appears to consist in cooling drinks, purgatives, and antiphlogistics, as prescribed by the Italian medical officers, who commonly attend on the sick in Turkey.

MEASLES—*Morbilli*.

Definition.—The eruption of a crimson rash, consisting of slightly elevated minute dots disposed in irregular circular forms, or crescents; preceded by catarrhal symptoms for about four days, and accompanied with fever. It affects the system only once; and sometimes prevails as an epidemic.

Pathology.—That a poison is absorbed in cases of measles, and infects the blood, there can be no doubt, and after a given period of latency acts on the great nervous centres, inducing a continued fever, which does not remit on the appearance of the eruption. The fever thus established at the end of three, more generally of four, and in some few instances of five days, is followed by a certain secondary or specific inflammation of the skin and of the mucous membranes of the eyes, nose, mouth, fauces, and bronchia, in addition to the fever. In a few cases the poison has certain tertiary actions, and produces inflammation of the substance of the lungs, or of the pleura. As the primary fever lasts from three to five days, and the eruption from six to seven days, the whole duration of the disease is from nine to twelve days. Whenever the tertiary actions occur, the disease is so much more prolonged.

The rule that fever precedes the specific actions of the poison has scarcely a recorded exception; and consequently, though the pyrexia may greatly vary in intensity, it is uniformly present. The fever which precedes the local lesions is termed the primary fever; and the premonitory phenomena of cough, sneezing, and general *malaise*, are usually more prolonged than in the other eruptive fevers. It does not always happen, however, that the functions of the mucous membrane are disordered, as well as the cutaneous surface. There are cases in which no catarrhal symptoms exist, and such cases are described as "*morbilli sine catarrho*." Such cases occur during epidemics of the disease, and are but few in number.

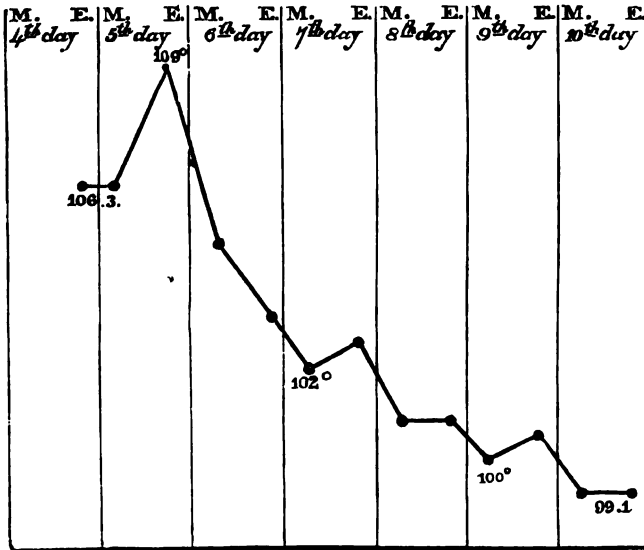
Since the affection of the skin is uniformly present, while that of the mucous membranes is sometimes absent, the cutaneous eruption is necessarily the great characteristic of the disease; but the morbillous eruption being evanescent after death, we can only imperfectly trace its pathology. It first appears as a circular spot or blotch, similar to a flea-bite, slightly prominent, and scarcely sensible to the touch. Its colour is of a pinkish red or deep raspberry hue, and in rare instances, as in the *morbilli nigri*, is livid or black. In severe cases, also, especially if the patient be of tender age, the eruption assumes a papular form, and, when at its height, occasionally a vesicular form; the latter being most common on the arms, the neck, or the breast. The colour of the eruption is evanescent on pressure, but returns on the finger being removed.

The patches of the eruption are extremely numerous, so that little of the healthy skin intervenes between them; and they not unfrequently become confluent, forming large maculæ, sometimes of a semi-lunar form. The principal seats of the eruption are the face, back, and loins; the parts least affected are the pudendal and popliteal regions. The inflammation of the cutaneous texture extends in some degree to the subjacent areolar tissue, for the face is tumid and swollen, but not so as to close the eyelids.

The eruption does not at once cover the whole body, but occurs in three crops, each of which follows the other at an interval of twenty-four hours,—the duration of each crop being from three to four days. The course of measles, then, in its most simple uncomplicated form, is, that on the third or fourth day of the primary fever, which is continuous, the first crop of the eruption appears on the face, neck, and upper extremities; on the following day the second crop covers the trunk; and on the third day the third crop appears on the lower extremities, so that the whole body is covered with the eruption, which is then at its height. On the following day (the fourth of the eruption) it begins to decline from the face, neck, and upper extremities; and on the next day it fades from the trunk. On the sixth or seventh day it is evanescent over the whole body; and terminates by resolution, followed by a furfuraceous desquamation of the cuticle generally. The maximum of the fever is reached about the fifth day; and it is immediately followed by a rapid and almost complete defervescence, the temperature sinking in one night two or more degrees (Fahr.) It continues to decrease throughout the following morning and day; and on the second day from the beginning of the defervescence the normal temperature is arrived at. It is only in very severe cases that this steady decrease is prolonged beyond twenty-four or forty-eight hours more. In severe cases the decrease of temperature may be slower and more protracted; but if the defervescence be more prolonged, it is a fair ground for suspecting some untoward complication.

A similar course of temperature, as regards defervescence, has been observed to obtain in cases of erysipelas of the face; but the fastigium lasts longer, and the epoch for the commencement of the defervescence vacillates between the fourth and eighth days.

THE FOLLOWING DIAGRAM REPRESENTS THE TYPICAL RANGE OF TEMPERATURE IN A CASE OF MEASLES. THE RECORDS INDICATE MORNING (M.) AND EVENING (E.) OBSERVATIONS, COMMENCING ON THE EVENING OF THE FOURTH DAY OF THE DISEASE:—



Line of Normal Temperature, 98° Fahr.

The inflammation of the mucous membrane, of the eyes, and nasal fossæ, indicated by more or less constant sneezing, generally commences either with or before the primary fever, and consequently precedes the eruption by some days. This inflammation is perhaps, for a few hours, confined to fixed spots, and is marked by itching at the mucous orifices, then it becomes diffuse, and quickly changes to the serous; for a profuse watery discharge from the eyes and nostrils shortly follows, technically termed "coryza." This affection usually continues till the decline of the eruption, and in some cases to a later period.

The mucous membrane of the mouth and fauces also inflames, but the inflammation differs from that of the eyes and nose, in not being accompanied by any discharge. In other respects it is exactly similar to the cutaneous eruption, for a number of exanthematous patches, more or less confluent, are seen upon the palate, uvula, tonsils, and *velum pendulum palati*, and they,

equally, terminate by resolution. They appear also at the same time with the eruption on the face, neck, and upper extremities, but do not decline till the eruption fades from the body generally.

The bronchial and tracheal mucous membranes are usually attacked, either before or at the same time with the buccal membrane, but whether the inflammation, of which they are the seat, is marked by the same characteristic eruption, is not determined, for few patients die at this early period of the disease. The cough and expectoration, however, which indicate the attack, and accompany it, are constant, and the latter shows that it partakes of the same serous character as that of the nasal and ocular membrane. Again, towards the close of the disease, or even as late as the third or fourth day after the eruption has disappeared, the poison not unfrequently affects the substance of the lungs or pleura, and thus constitutes the most dangerous complication of measles. When the substance of the lungs is affected, a serous exudation pervades that tissue, and the quantity of fluid effused is frequently so considerable as to stream from the lung as soon as its tissue is divided. In severe forms of the disease, either the red or grey hepatization of the lung may supervene, but these results are rare. The pleura does not at all times escape the morbid action; and the diffuse, the serous, the adhesive, and even the purulent inflammation may invade that tissue, and either destroy the patient or retard his convalescence. Diarrhoea also is often an accompaniment, which renders it probable that the mucous membrane of the intestines may be a surface on which any exudation peculiar to the disease may take place. Few analyses of the urine in cases of measles have been made. Albumen is extremely common in some epidemics, and appears simultaneously with the eruption; it may then disappear, and reappear during the fading of the rash. Blood in small quantities is also common. In the Leith epidemic of 1854 the recoveries were most speedy when the albuminuria was the greatest. (*Parkes On the Urine*, p. 262.)

Symptoms.—The symptoms of measles result from the fever, and the consecutive local lesions. The varieties of the disease, however, are extremely few, for no instance is known of a morbillous fever without the secondary or specific actions following; but the poison is supposed, sometimes, to limit its action to one membrane, as the cutis, and to exhaust itself on that tissue; and hence, the

"morbilli sine catarrho." The varying intensity also of the disease enables us to divide measles into two grades—namely, the *"morbilli mitiores"* and the *"morbilli graviores."*

The primary fever may make its attack suddenly, or be preceded for a few days with symptoms of a common cold, and in general the latter is the case; but in no instance is the primary fever (which is afterwards prolonged, and accompanies the eruption), at any time, of great intensity. Although many children may die from the severity of the local lesions, yet no instance is known of the patient being overwhelmed or destroyed by the general depressing action of the poison, as in typhus fever or scarlatina. The depressing powers of the poison, however, are considerable, and are always sufficient to confine the patient to his bed for a few days, and to leave him, for a short time after the disease has subsided, weak and debilitated. The type of the fever of measles consequently greatly differs from that of typhus or of scarlatina, and the formidable brown tongue, so grave a symptom in the latter, is hardly known in the former, or only seen in a few fatal cases.

Morbilli Mitiores.

The essential characters of this affection are, that the poison produces primary fever, and a specific inflammation of the skin and mucous membranes,—the fever not subsiding till the eruption fades.

The symptoms may be divided into three stages: the first embraces the primary fever, or the period before the eruption, and may last from three to five days; while the second stage embraces the period of the eruption, and lasts from six to seven days. These two stages very commonly comprise the whole disease, whose usual course is from nine to twelve days. The third stage includes any inflammatory action which may be caused by the tertiary action of the poison, and therefore only occasionally exists.

The early symptoms of the primary fever are seldom severe, and greatly resemble those of an ordinary acute catarrh. They are shivering, alternated with heat, frequent pulse, headache, derangement of the bowels, sometimes accompanied by nausea and vomiting; and these affections are so considerable that the patient usually takes to bed. At the end of a few hours the fever becomes continued, and the specific action of the poison commences

by the mucous membrane of the eyes and nose inflaming, so that the light is painful; the senses of smell and taste are lost, followed by a copious discharge of serum from the nose and eyes, attended with more or less constant sneezing.

The buccal and bronchial membranes may become affected at the same time, and the patient is then troubled with a frequent cough, which has this peculiarity, that it occurs in paroxysms. The cough does not remit till about the seventh day, and is often accompanied by hoarseness, by a sense of constriction across the chest, by diarrhoea, and sometimes by ischuria. The duration of this first stage may be three, four, five, or even six days.

The second stage commences with the appearance of the eruption, whose course and character has been described. On the appearance of the eruption the fever is often aggravated, but the distressing nausea and vomiting seldom last beyond the fourth day. The fever, therefore, together with the coryza, sneezing, coughing, hoarseness, and diarrhoea, continue with unabated severity till the eruption has reached its height, and is fully out over the whole body, which is on the third or fourth day after its first appearance. From this period, in favourable cases, all the symptoms begin to decline; and on the eruption disappearing the cuticle desquamates, and the disease terminates on the ninth, tenth, or eleventh day from its commencement.

In a few cases, however, on the subsiding of the eruption, or about the ninth, tenth, or eleventh day of the disease, and in some instances earlier, the pectoral symptoms do not subside as they ought to do, but the tertiary actions of the poison are set up, and inflammation of the substance of the lungs or of the pleura takes place, prolonging the duration of the disorder, and endangering the life of the patient. The inflammation of the bronchial membrane is denoted by the expectoration either of a thick viscid mucus or of pus, and which may or may not be streaked with blood; while the mucous or sonorous rattle will point out the peculiar seat and extent of the mischief. If the substance of the lungs be inflamed the breathing is more difficult, the cough more troublesome, and the countenance livid; but the loud mucous rattle which accompanies it seldom allows us to hear crepitation, or to determine the absence of respiration in any given portion of the lung. If the pleura be inflamed, we have, in addition to the cough, severe pain in the side, and an impos-

sibility of filling the chest with air, except in a very limited degree; and this is often accompanied by dullness on percussion, by bronchophony or ægophony, assuring us that fluid is effused into the cavity of the chest.

Morbilli Graviore.

The main characteristic of this severe form of measles is the eruption becoming suddenly black, or of a dark purple with a mixture of yellow. The early writers on measles describe this form of the disease as being much more common in their time than we find it to be in the present day. Sydenham considers this appearance as extremely formidable, and that persons so seized are irrecoverably lost, unless they are immediately relieved by bleeding and a cooler regimen. Willan writes that he has seen this discoloration, but thinks more lightly of it.

The eruption is sometimes greatly delayed from causes not quite manifest. Excessive purging is thought to have this effect, or anything which greatly debilitates the system, hereditary or acquired unhealthiness of constitution, or the peculiarly malignant nature of the disease. The occurrence of the eruption is therefore to be looked for with anxious care, as the appearance of it, even though late, is in itself a favourable indication.

If the eruption suddenly disappears, or "goes in," it is no less an unfavourable omen, and is apt to be followed by dangerous results, diarrhœa, dyspnœa, coma, convulsions, all which unfavourable signs may again disappear on the reappearance of the eruption.

Diagnosis.—The diseases with which measles may be confounded are scarlet fever and some forms of syphilitic eruptions. The diagnostic symptoms between measles and scarlet fever are numerous; for there are many differences, both in the general course of the fever, the ranges of temperature, and particular symptoms of these diseases, by which they may readily be distinguished from each other. Thus, the periods of the latency of the poisons are different—that of scarlet fever being from two to ten days, while that of measles is from ten to sixteen days. The eruption in scarlet fever seldom appears later than the second day of the primary fever; in measles it is delayed till the fourth day. In scarlatina the exanthematous patches are large, and the csurfae they cover ample; but in measles they are not larger

than flea-bites, and when most confluent the clusters are small, sometimes forming crescentic patches. The colour is also different, being of a bright red in scarlet fever, while in measles it partakes more of a pinkish red or raspberry hue. The affections of the mucous membranes are also different in the two diseases. In scarlatina the tonsils are almost always greatly enlarged and ulcerated, while in measles they are little or not at all affected. In scarlatina the eyes are free from coryza, while in measles this is the most prominent symptom. The tertiary actions of the poison are also different, being, in scarlatina, inflammatory affections of the joints, and dropsy; while in measles they are inflammations of the lungs or pleura; and lastly, in measles the fever usually subsides on the disappearance of the eruption; but in scarlatina the fever often continues many days or weeks after the eruption has run its course, or till the sore throat has healed.

Prognosis.—The mortality from measles greatly varies in different years. During each of the four years previous to 1858 the proportion of deaths from measles in every 1,000 deaths from other causes has been, in 1851, 24·107; 1852, 14·599; 1853, 11·818; 1854, 21·463. Percival says, that out of 3,807 cases of measles, 91 died, or 1 in 40. Watson says, that in one year, at the London Foundling Hospital, 1 in 10 died; and in another 1 in 3. In the same establishment in 1794, out of 28 cases, none died; in 1793, out of 69 cases, 6 died; in 1800, out of 66, 4 died; and the aggregate of these data will give us an average of 1 death in 15: so that the prognosis in every case of measles is favourable in the first instance. The prognosis, however, is more favourable in the country than in large metropolitan towns; for it appears by the Registrar-General's reports that the proportion *per cent.* of the population that died of measles in London is much greater than in England and Wales.

The chief danger arises from bronchial and pulmonary inflammation, and the danger of this is greater after the disease has begun to decline, than during its progress. An epidemic of measles occurred at Kiel in 1860. In the fatal cases the chief cause of death was a peculiar state of the lungs, which in part were collapsed, with *foci* of purulent infiltration in various parts, or a condition of carnification. Intense bronchial catarrh was present, extending to the minuter ramifications of the air tubes, but not of a croupal character. (Virchow's *Arch.*, vol. xxi., p. 65; *New*

Syden. Society Year-Book, 1861, p. 132.) In strumous patients measles may end in the development of miliary tubercles in the lungs; increasing cough, emaciation, and a harsh, dry skin being the untoward symptoms of such a result.

Croup also sometimes supervenes and cuts off young patients. It tends to be of the asthenic type, and is not unfrequently preceded by diphtheritic inflammation of the fauces, which gradually passes down to the larynx.

Diarrhœa is another danger to be encountered. During convalescence there is a tendency to looseness of the bowels, but which, if moderate, ought not to be counteracted, as it is commonly rather advantageous; but if suffered to continue the consequences may be fatal.

Catarrhal ophthalmia, if the constitution be strumous, must also be watched for, and, if possible, prevented.

Measles, in any of the malignant forms described, is highly dangerous; and the danger is greater in the old than in the young—in cold than in warm weather.

Causes.—Measles were first noticed at the same time and in the same country with scarlet fever, and the two diseases have subsequently followed nearly the same course. They now prevail all over the world, are little influenced by season, are believed to be constantly in existence somewhere, and occasionally epidemic.

Measles, though incidental to every period of life, are most frequently contracted in childhood, when it is difficult to trace the effects of accidental circumstances, so that our knowledge of the predisposing causes are most imperfect. Both sexes, however, appear to be equally liable to this affection. With respect to the influence of season, it is generally supposed that measles break out most readily in the beginning of winter, increase till the vernal equinox, and then tend to subside towards the summer solstice. The deaths, however, from this disease, registered in England and Wales, show that the influence of season is exceedingly trifling.

Propagation of the Disease by Direct Communication and Infection.—It is admitted by all authors that a patient labouring under measles generates a poison which may be communicated directly, or which may contaminate the atmosphere with an impalpable poison.

This disease, like scarlatina, is thus eminently communicable;

and in like manner no susceptible person can remain in the same room, or even in the same house, without hazard of taking the disease. In the year 1824 it was imported into Malta by some children belonging to the 95th regiment, and spread extensively in that island, so that many natives died. This circumstance was the more remarkable, as measles had not been in the island for many years. The *infecting distance* of this poison, it will be plain from what has been stated, must be considerable; indeed, it is often very difficult to isolate the disease in our public schools, or other large establishments, where it sometimes appears.

The fact of measles being communicable has often been proved; but some difference of opinion exists as to the possibility of communicating the disease by inoculation. Healthy children have been inoculated, either by blood drawn from the arm of a patient suffering from measles, or with serum taken from the vesicles which are occasionally found intermixed with the eruption,—an experiment which appears to have been first made by Dr. Home, with a view of producing a mild disease; but as no such result has been obtained, the practice has been abandoned. Many trials of this kind have also failed to produce the disease, yet on the whole successes are sufficiently numerous and varied to warrant the statement that a specific poison communicates the disease.

This disease is also propagated by fomites. The strictest demonstration of this fact is, that the disease has been communicated by direct application of substances impregnated with the virus in the attempts to inoculate for the measles; it is also proved by the fact that childrens' clothes, sent home in boxes from schools where the disease has raged, communicate the disease; and also by the same circumstance resulting when susceptible children have lain in the same beds, or in the same room, shortly after it has been occupied by patients suffering from the disease. Cold weather appears favourable to the development and propagation of the disease. No age is exempt, from the foetus in the womb to the second childhood of old age; but it is much more frequent in children than in adults, and there are few who have not an attack of measles at some period of life.

The morbillous poison having once produced its specific effects, as a general principle, leaves the patient exempt from all liability to a second attack. This law may be considered as proved both by Willan and Rosenstein—the former affirming that, after an

attention of more than twenty years to eruptive complaints, he had not met with an individual who had twice had "febrile rubeola;" while the latter states that, in a practice of forty-four years, he had met with no instance of a second infection. There are, however, occasional exceptions to the rule. One variety of this disease—namely, the *rubeola sine catarrho*—is supposed to afford no protection against an attack of the *rubeola vulgaris*. There are many exceptions also to the non-susceptibility of persons who have passed through the *rubeola vulgaris*; for Burserius, Robedieu, Home, Baillie, Rayer, and Holland, have all seen instances of a second attack of the measles in the same individual.

The period of latency of the poison of measles is determined to vary from ten to sixteen days. It seems also ascertained that the specific poison of measles is generated as soon as the primary fever is established, and before the eruption appears.

Treatment.—The nature and course of measles differ from scarlet fever not only in the fever being much less depressing, but in running a shorter and more certain course, and in having no tendency to terminate in ulcerations or mortification of the skin. The constitution during measles is little impaired by the short continuance of the disease, and consequently admits of a more strictly antiphlogistic treatment.

As no antidote is known to the poison of the measles, the disease will run its course whatever treatment we adopt. The rule, therefore, is to interfere as little as possible as long as the disease is safe, and merely to attempt to moderate symptoms when they threaten danger; and to subdue them, if possible, when danger really appears.

The *morbilli sine catarrho* is usually of such a mild form as to require no other treatment than a milk diet, and the customary attention to the bowels, and the prevention of exposure to cold and wet. Measles will not bear exposure of the surface of the body to cold so well as either scarlatina or small-pox, on account of the great tendency to bronchial and pulmonary inflammation. Children must therefore be watched night and day to prevent them lying uncovered, and special care must be taken to avoid exposure to cold during convalescence. In the *morbilli mitiores* the cough, the frequent vomiting, and the heavy catarrhal symptoms which so generally attend the primary fever, render medical

attendance necessary from the first moment of the attack. The treatment of these symptoms, however, and also of the eruptive stage, as long as the patient continues free from any serious inflammatory affection of the lungs, need not necessarily be active, it being sufficient to alleviate the cough, allay the vomiting, and check the catarrh by some of the large class of saline laxatives, lintseed tea, mucilaginous mixtures, to which antimonial wine may be added, if necessary, as a diaphoretic, and to subdue high vascular action. In making a selection from these, the physician must be principally guided by the state of the bowels and the condition of the stomach of the patient. If the bowels be constipated, the milder purging salts, as the sulphate of magnesia, are to be preferred. On the contrary, if the patient be purged, and the vomiting distressing, a neutral mixture or effervescing draught will be found most beneficial. There are many persons in whom the cough and catarrh are the most urgent symptoms; and in such cases, if the stomach be quiet, the *liquor ammoniæ acetatis*, in half ounce doses, combined with camphor mixture, from its more powerful action on the skin, is an excellent substitute. Another remedy, equally or perhaps still more useful, is ipecacuanha, of which from one to two grains may be given every four or six hours. Some practitioners prefer antimony to ipecacuanha, but antimony appears, at least in large doses, to act in some instances perniciously on the lungs.

The treatment which has been specified is, in most cases, all that is necessary throughout the whole course of the disease; and the greatly extended experience of Willan hardly enabled him to enlarge it. He was of opinion, however, that an emetic given on the second or third evening *somewhat* alleviated the violence of the catarrhal symptoms, and contributed to prevent the diarrhœa which usually succeeds the measles. An emetic is especially useful if the disease be threatened with croup as a complication. During the eruption, he adds, "I have not observed any considerable effect from antimonials or other diaphoretics." Bathing the feet every evening seems a more beneficial application. Emulsions and mucilages afford but a feeble palliation of the cough and difficulty of breathing. With respect to opiates, they are not generally advisable; in the early stages especially, according to Willan, opium produces an increase of heat and restlessness, without conciliating sleep.

The catarrhal symptoms are frequently accompanied, even in the very earliest days of the disease, with much bronchial inflammation, and sometimes with pneumonia; or, these affections may occur at any later period, after the decline of the eruption, from the tenth to the twelfth day of the attack. This great tendency to pneumonia has caused the question to be agitated, whether bleeding ought not to be adopted as part of the treatment of this disease in all cases, either as a means of cure or as a precautionary measure; or whether it should be reserved until the pneumonic symptoms are present. Although experience has shown that bleeding may be practised with impunity in the very first onset of the disease, or at any subsequent stage, if the constitution of the patient is otherwise good, yet it is very rarely necessary to bleed before the subsidence of the eruption; for, if we wait that event, we "usually find the pulse become moderate, and the uneasy, laborious respiration terminate in twenty-four hours. This oppressed breathing is common to other eruptive fevers; and if it were universally to be considered as an indication for bleeding, the practice would often be more fatal than the disease" (WILLAN). If, however, pneumonia or pleurisy be at all threatened, blood should be freely but not extravagantly taken; for it should be remembered that although some children bear the loss of blood well, yet that others are long in recovering from it, even when the quantity drawn is small. In children, then, below ten years of age, when it is considered necessary to withdraw blood from them, it is more prudent to take blood frequently and in small quantities, than in a large quantity at once. We should likewise be content with moderating the symptoms; for, as the inflammation depends on a morbid poison, it has a course to run, and does not admit of a cure. The bleeding should also be more moderate during the eruption than after it; for we have a right to look for a diminution of all the symptoms as the eruption naturally disappears. Blisters, ipecacuanha, and mercury are amongst the best *adjuvantia* to bleeding in severe cases. In cases where miliary tubercle may be suspected to grow, good results have been obtained from quinine, nutritious diet, and wine, and at the same time introducing mercury into the system by friction over the chest. A little croton oil added to blue ointment promotes its absorption (ANDREW ANDERSON). In the Kiel epidemic already noticed, leeching and emetics, employed moder-

ately, were unsuccessful; but the alternate application of towels dipped in hot and cold water had very good effects, but required to be continued for hours or days. The disease was very prone to relapse, and never pursued the typical course of a simple pneumonia.

During the whole course of the disease, it is necessary to enjoin an abstinence from all animal food, and to limit the patient to a low diet and to slops. The chamber should be of a moderate temperature, not subject to any sudden change from heat to cold, and the strictest cleanliness should be observed. With a view to protect the eyes, the room should be kept dark, so that the patient may be prevented reading, or using his eyes. In large establishments separation is necessary, to prevent spreading of the disease if possible. Should the eruption disappear or be retarded, and untoward symptoms appear, such symptoms must be carefully studied, as prompt measures may be demanded, with the object of bringing the eruption "out," and subduing internal irritation or inflammation. A most efficient help is the hot or vapour bath. Warm drinks may also be given; and if there are no bronchial symptoms, or evidence of cerebral oppression, a dose of compound powder of ipecacuanha will be of service, proportioned to the age of the patient.

When convulsions occur in children, hot foot baths sometimes give relief, as well as sinapisms to the limbs; after which, if they do not subside, blood must be taken by leeches from the temples; and it is in all cases necessary to determine the most probable source of the irritation, giving rise to the convulsions—*i. e.*, whether they depend upon the specific poison of the disease, upon dentition, or upon intestinal irritation or cerebral disorder. Diarrhoea should not be checked suddenly, but kept under control.

SCARLET FEVER—*Scarlatina*.

Definition.—*A febrile disease, the product of a specific poison, which is reproduced during the progress of the affection. On the second day of the illness, or sometimes later, a scarlet efflorescence generally appears on the fauces and pharynx, and on the face and neck, which spreads over the whole body, and commonly terminates in desquamation from the fifth to the seventh day. The fever is accompanied with an affection of the kidneys, often with severe disease of the throat, or of some internal organ, and is*

sometimes followed by dropsy. The disease runs a definite course, and as a rule occurs only once during life.

Pathology and Symptoms of the Disease in its Varied Forms.—After a definite period of latency, the peculiar poison of scarlet fever induces a disorder of the blood, which is, in the first instance, made manifest by a *febrile state* and a *disturbed condition of the great nervous centres*. The primary fever, having lasted for one, two, or three days, does not entirely subside, but the secondary actions of the poison are set up as a peculiar eruption, preceded, followed, or accompanied by a sore throat. The eruption runs a course of from six to eight days, but the duration of the affection of the throat is more indefinite, and varies from eight to twenty, or more days. The fever continues during the eruption, and as long as the sore throat exists; but this being terminated, it subsides, and the disease is ended. In a few instances, however, tertiary actions succeed, as dropsy or inflammation of the joints, diseases quite as formidable as any which had preceded them. As in ordinary fever, the poison of scarlet fever acts on the brain and its membranes, often causing the usual forms of inflammation of those parts, modified in their course and effects by the nature of the specific febrile disease.

That fever precedes the specific actions of the skin in this disease is so general a rule, that it has few exceptions, and the pyrexia has been occasionally so severe as to destroy the patient, before the more specific actions of the poison have been set up. Dr. Andrew Anderson writes that he has seen death take place in six hours from the commencement of the disease; the child, in fact, dying poisoned. (*On Fever*, p. 77.) In suddenness of danger, it thus approaches yellow fever and cholera. Again, the rule that the great specific action of the poison is expended on the skin, causing the specific eruption, has very few exceptions. Of this eruption there are several forms, such as *smooth*, *papulose*, *phlyctenoid* or *vesicular*. These are all evanescent after death.

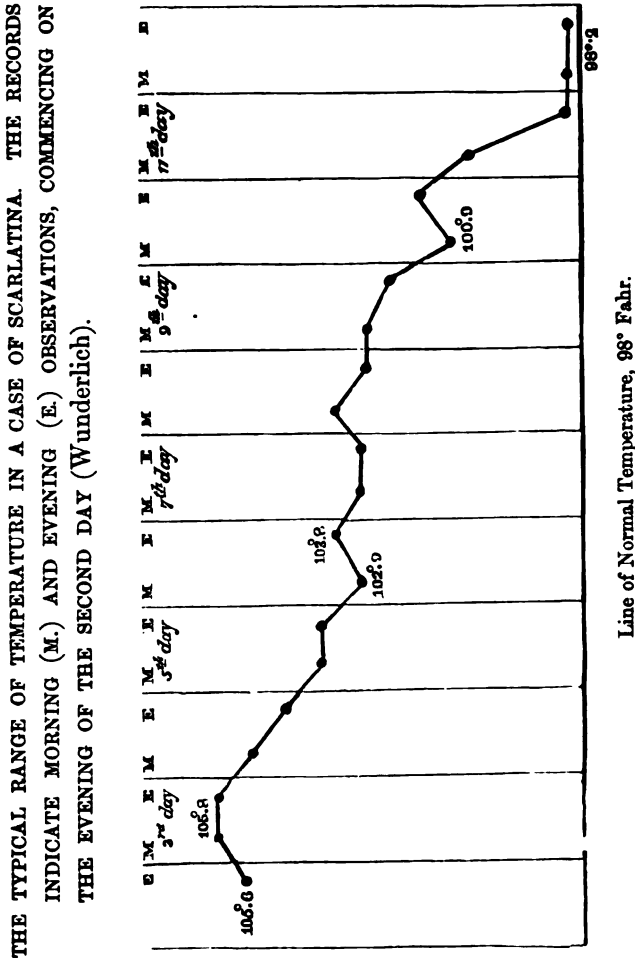
In the smooth eruption the surface of the inflamed skin presents no inequality either to the sight or touch. The *scarlatina papulosa* has an eruption in which the papillæ of the skin are enlarged, and the appearance is that of roughness, or "goose-skinned." The third form is, when the eruption is accompanied by a number of vesicles filled with serum, which ultimately shrivel up and desquamate.

Whatever the ultimate form of the eruption may be, its first appearance is by innumerable small bright red puncta, dots, or maculae, separated by interstices of healthy skin. These puncta or maculae are at first very minute points all over the affected parts of the skin, which are usually more or less rough to the touch; but they quickly become confluent, so that in a few hours the redness becomes general over the parts attacked. The colour, in ordinary cases, is in the first instance a bright red, like that of a boiled lobster, but on the decline of the disease it becomes deeper, and more resembles that of beet-root, while in severe cases it is of a pink blush rather than a scarlet efflorescence, or it may be livid, and intermixed with petechiae. But whatever tint the eruption may assume, it has this peculiarity, that it disappears on pressure, and again returns from the periphery to the centre on that pressure being removed. The colour is also always brighter and more vivid in the flexure of the joints, and about the hips and loins, than over the rest of the body. A pathognomonic sign of scarlatina, in connection with the eruption, has been described by Bouchut. It consists in an induring white stripe, produced by pressure with any hard substance on the skin occupied by the eruption. This phenomenon is ascribed to an increase of the contractile power of the capillaries, and which is proportionate to the intensity of the disease, the regularity of the eruption, and the amount of vital power. (*Syden. Society Year-Book*, 1861, p. 130). The termination of this inflammation is generally by desquamation of the cuticle, and the desquamation generally begins with the decline of the eruption; and is usually completed by the end of the second week, unless it is longer delayed by successive crops of eruption, and consequent succession of exfoliations. There is no fever in which this phenomenon is more conspicuous. A few days after the commencement of the desquamation, albumen may be detected in the urine in small quantity, which continues to be given off for several days, along with a considerable amount of epithelium from the uriniferous tubules (DR. J. W. BEGBIE). There are also cases in which the albuminuria is associated with *anasarca*; and three stages have been recognized in which this complication occurs:—(1.) A febrile stage, characterized by fever of an intermittent character, and by rapid serous extravasation and infiltration; (2.) A chronic stage, in which the affection follows a slowly progressive course; (3.) A

period of resolution (HAMBURGER). Such cases sometimes terminate by uræmic symptoms and convulsions. An unusual case of this nature has been recently recorded by Biermer. It happened with a boy five years and a half old, and ended fatally on the thirty-fifth day. No urine was passed for 108 hours between the twenty-first and the twenty-sixth day of the disease, and extremely little for five days more. Yet during these ten days there were no uræmic symptoms, nor any notable dropsy. The uræmic symptoms first set in after the urine began to be secreted freely, and it was but slightly albuminous. (*Syden. Society Year-Book*, 1861, p. 218.) Occasionally the *squamæ* are so large as to preserve entire the whole epidermis of the palms of the hands and of the soles of the feet—frequently it is furfuraceous or scaly. Frank has seen them come away with the hair, nails, and even with *veruæ* attached. In a few instances, however, the termination is by ulceration and sloughing of large portions of the integument.

Whatever may be the colour or description of the eruption, it does not attack all parts of the body simultaneously, but appears partially or in a succession of crops, the order of which may be stated as follows:—On the first day it spreads universally over the face, neck, and upper extremities; on the following day over the trunk, but is less general on the back than on the abdomen; and, lastly, on the third day, it has extended itself over the lower extremities. The duration of each crop is about three days, when it disappears, and in the order of attack, falling from the head and upper extremities on the fourth day; from the trunk on the fifth day; and from the lower extremities from the sixth to the eighth day. The order of attack, however, which has been mentioned is not constant, for in some few instances the eruption appears first on the trunk and lower extremities, and only on the second day very faintly on the face and upper extremities. The disease attains its height, and the fever maintains its course usually from the fifth to the ninth day, when, in favourable cases, continuous defervescence sets in, and all the symptoms begin to decline. The fever does not subside on the appearance of the rash, as is the case with small-pox, but continues, with various degrees of violence and ranges of temperature, throughout its progress. The pulse is often 120 to 130 in a minute, and sometimes beats with considerable force. The skin frequently indicates by the thermometer a temperature of 105°, 106°, or even

112° Fahr.; and it is dry, with a sensation of burning heat, till about the third day. From the third to the ninth day the range is maintained between 103.8 and 102.9, and begins to subside about the tenth day, after which the defervescence is continuous. The difference in these respects between scarlatina and measles may be appreciated at once by a glance at the account and the diagram given of measles, and comparing it with the following, which shows



There is no remarkable increase of fever heat preceding complete defervescence; and after the *exanthema* has reached its maximum,

the decrease of temperature proceeds by no means rapidly. The commencement of the decrease may be marked by a few decided and rapid falls; but its farther fall is decidedly lingering, and is even sometimes interrupted by small increases of temperature, so that the whole process of defervescence occupies, as a rule, from five to eight days. It is only in very mild or anomalous cases that the temperature rarely exceeds $101^{\circ}8$ Fahr.; and these cases sometimes show a rapid defervescence, completed in a single night. It is essentially a short fever, the ranges of temperature, according to Mr. Sidney Ringer, forming cycles composed of a variable number of days, generally of five; a fall of temperature taking place on the 5th, 10th, or 15th day of the disease. (*Med.-Ch. Society Trans.*, 28th January, 1862.)

The poison of scarlatina as frequently falls on the mucous membranes of the eyes and nasal fossæ, and excites a similar eruption over those parts, as on the skin, at first consisting of a distinct punctated or dotted appearance, which changes in a few hours to one of diffuse redness. The inflammation of the ocular membrane, however, has this peculiarity, that it does not distress the sight, for the eye bears light without inconvenience, and in no case is it combined with coryza. Neither is sneezing a consequence of the affection of the nasal membrane; and only in a few severe cases is there any discharge from the nostril. As the eruption attacking these parts generally appears with the first crop of the *exanthema* of the skin, so does it generally die away with the cutaneous eruption. This inflammation usually terminates by resolution; but in a few instances the alæ of the nose ulcerate, and sometimes mortify.

The lingual and buccal mucous membranes are also often the seat of a similar exanthema, presenting nearly the same appearance as in other parts. The papillæ of the tongue, however, are singularly elongated and enlarged, and stand up salient and erect, and of a deep scarlet colour, above the thick, white, creamy mucus fur which coats the lingual membrane; and hence the term "strawberry tongue," from the supposed resemblance to the exterior of a strawberry. The tip of the tongue is of a vivid red, through development of the papillæ. By and by the fur falls off, and the whole dorsum of the tongue is then left clean, red, and raw-looking. This affection lasts longer than that of the eyes and nose, and usually terminates by

resolution, although, in a few instances, the buccal membrane ulcerates and mortifies.

The sore throat, or inflammation of the faucial membrane, though not so constant an affection as that of the skin, yet, when it does exist, it is often of much longer duration, and is a much more grave disease. It may either precede all the other symptoms, or it may occur at any period of the fever. This inflammation, at first punctated, then diffused, usually runs into ulceration, and the character of the ulcer is so completely in unison with the state of the constitution as to enable us, according as it is slight or severe, to divide scarlatina into two great varieties,—namely, into "*scarlatina mitior*," and into "*scarlatina gravior*." The first, or sthenic form, is marked by a greatly enlarged or swollen state of the tonsils, which are of a vivid or bright red colour; and, when ulceration takes place, the ulcers are seldom deep, or the sloughs slow to come away, but usually they separate about the fifth or sixth day; so that in mild cases the sore throat is healed about the eighth or tenth day, and in more severe ones about the fifteenth or twentieth. In malignant cases, or in *scarlatina gravior*, the tonsils are much less tumefied and enlarged, but much more loaded with blood, and of a deeper, and sometimes of a livid colour. The ulcers, also, are deep and formidable, and the sloughs are thrown off later in the disease. They are likewise slow to heal, or not till the end of three weeks, and in severe cases not till four or even six weeks have elapsed, during which period the fever continues, and the patient remains in considerable danger.

The inflammation of the throat is not limited to the tonsils, but extends over the fauces generally and uniformly, or symmetrically on either side, as is common with blood diseases. It may extend to all the neighbouring parts, and an abscess may form in the pharynx, or pus may issue from the ears. The tympanum has been eroded, and in a few instances the inflammation has extended to the larynx, and the patient has died of croup. Besides these disorders, the glands of the neck often enlarge and occasionally suppurate, and, singular to say, sometimes not till after the sore throat has healed, and sometimes when there has been no previous affection of the throat, as if these parts were the seat of a specific action of the poison. Glandular swellings on both sides of the neck are not unfrequent; and have been

described as "the scarlatinal bubo" (TROUSSEAU). They may be the best and most accurate index of danger in the later period of scarlatina, in so far as the danger depends on the sore throat, and on the putrid infection of the blood (septicæmia) which accompanies it. (W. T. Gairdner, *Clinical Medicine*, p. 193.)

The inflammation of the cutis, as also of the buccal mucous membrane, is usually accompanied by some inflammation of the submucous or subcutaneous areolar tissue. This affection takes place as soon as the rash appears, and causes the hands to swell, so that the patient is unable to bend his fingers, and his face also becomes tumefied and painful. The serum effused, however, is, in mild cases, absorbed, and the disease terminates without any unpleasant consequences. In severe cases, however, it has a tendency to terminate in ulceration or in mortification. In children the toes of one foot have been known to slough off; and in some the integuments of the leg have mortified from the knee to the foot; while in others, mortification, commencing in the upper lip, has been known to spread till one-half the cheek was eaten away. Some have been known to die of mortification of the rectum, and others of a similar affection of the pudenda.

Such are the primary and secondary affections of scarlatina; but this poison has also some tertiary actions, giving rise to dropsy, as well as affecting the synovial membranes of the joints.

The dropsy which sometimes occurs after scarlet fever, usually commences between the fifteenth and twenty-third day of the disease, and, almost uniformly, not till after all the other symptoms have subsided. The patient is liable to it during desquamation, as already mentioned, and for a considerable time afterwards. It begins with anasarca of the face, and afterwards of the hands and feet. In some instances the anasarca is universal, the whole areolar tissue of the body filling so rapidly as sometimes to destroy the patient in a few hours; the cavities of the chest and abdomen frequently filling at the same time. According to the observation of Dr. Wood and many others, it has occurred more frequently after mild than severe cases. Its forms are, therefore, *anasarca*, *ascites*, *hydrothorax*, *hydropericardium*, and even *hydrocephalus*; and in whatever form, heaviness approaching to stupor is a common attendant; and, during the progress of the fluid effusion, cedema of the glottis must be watched for and relieved. The dropsy is generally accompanied with scanty and albuminous urine; and

although the presence of albumen, without diminished secretion, is almost a regular phenomenon in the course of the disease, independent of dropsy, as shown by Dr. James W. Begbie, yet, if the urine become highly albuminous and diminished in quantity, the dropsical complications may be apprehended. (*Ed. Med. Jour.*, Jan., 1849, and Oct., 1852.)

More or less congestion of the kidneys occurs in every case of scarlet fever, although, like the sore throat, it may often be so slight as not to give rise to any prominent symptom (BEGBIE, ANDERSON). The scarlatinal dropsy is very generally considered as most intimately connected with the kidney disease; and when the kidney disease is well marked, the characters of the urine exactly resemble those in acute Bright's disease (PARKES). On the other hand, there is also evidence decidedly in favour of the opinion that albuminuria may be wanting in scarlatinal dropsy. (See Parkes *On the Urine*, p. 264.)

The condition of the urine in scarlet fever ought to be ascertained daily in every case, especially during the period of convalescence. "It is of more importance," writes Dr. Andrew Anderson, "that you should examine the urine, than that you should feel the pulse of a convalescent from scarlet fever." The urine has the ordinary febrile characters. During the first six days the amount is small; the urea and uric acid are increased in amount, and sediments of urates occur. The chlorine is sometimes greatly lessened, and augments during convalescence. On the sixth to the eighth day, if the case goes on well, the urine becomes abundant, pale, and the re-action neutral or feebly acid. There is bile pigment present during the first six days; and in a large proportion of cases, though not in all, the urine becomes albuminous. Dr. Warburton Begbie believes it to be present at some period in almost every case. It is usually associated with a large amount of renal, pelvic, and bladder epithelium, but not with renal cylinders (BEGBIE), unless there be dropsy. The albuminuria occurring during desquamation is usually transient; but it may continue till an attack of dropsy occurs—disappearing and reappearing, when dropsy comes on a fortnight or three weeks later. In malignant scarlatina, as in malignant variola, there may be considerable hæmaturia or passage of dissolved hæmatin. (Parkes *On the Urine*, p. 263.)

Intercurrent inflammations of the synovial membranes have

been described by Withering, Sennertus, Heberden, and others. This disease may attack the wrist, ankle, or knee-joints, and usually terminates by effusion of serum; and in some cases the cavities of the joints contain pus. This inflammation seldom occurs till after the eruption has subsided, and is generally a tertiary phenomenon in the course of the specific disease.

Such are the morbid phenomena which have been observed in the ordinary course of scarlatina, and with sufficient constancy to be attributed to the specific action of a poison; but these appearances are only to be found when the disease is of moderate intensity and the patient survives some days. In severe and rapid cases the patient dies, not from any organic lesion, but from the intensity of the shock, in the first instance, on the nervous system—for Bretonneau, Tweedie, and Sims, all speak of having examined the bodies of persons who have died early in the disease, in which there was scarcely any appreciable lesion—coma, or other violent cerebral affection, carrying off the patient.

Although several varieties of scarlatina are described by authors, it is not to be supposed that they are equally distinctly defined in nature. Yet it not unfrequently happens that the characters of each variety are tolerably well marked. The following may be distinguished, namely,—(1.) "*Scarlatina simplex*" vel "*sine angina*;" (2.) "*Scarlatina anginosa*;" (3.) "*Scarlatina maligna*;" and (4.) "*Scarlatina latens*."

Scarlet fever, of whatever description, essentially consists of fever, already described, and certain local inflammations; but among the more striking phenomena of this disease is the sudden and remarkable depression of the mental and physical powers of the body which the poison produces—a depression so great as sometimes to cause the death of the patient in a few hours, without any re-action, or any very sensible local lesion of the throat or other part being discoverable after death. On the contrary, there are a few instances in which the re-action is so great as to destroy the patient in an equally short time, and with a similar absence of all pathological phenomena; the affection of the skin being suppressed, and the sore throat wanting, the patient dies as if from the influence of an overwhelming poison.

The symptoms of scarlet fever under ordinary circumstances may be divided into three stages. The first stage occupies the period from the commencement of the disease till the appearance

of the eruption, and is technically termed the "*primary fever*." The second stage, that from the appearance of the eruption till its entire subsidence; while the third stage is reckoned from the disappearance of the eruption till the termination of the disease. The duration of the first stage is one, two, or three days; that of the second from six to eight days; while the third stage may either not exist or vary from a few hours to two or three weeks, making the whole duration of the fever to vary from eight to thirty or more days. These stages are not, as in typhus, usually marked by changes of the tongue; for, except in the more severe forms of the disease, it continues coated with a white creamy mucus throughout the whole course of the disease. In "*scarlatina anginosa* or *maligna*," however, it becomes brown or black in the second or at the commencement of the third stage.

The primary fever may be sudden in its attack, or the patient may complain for some days of slight indisposition. The early symptoms, whatever be the variety, are headache, pains in the back and loins, loss of appetite, sickness, and white tongue. The disease is, indeed, usually ushered in by vomiting—sometimes by very obstinate and troublesome vomiting. In slight cases it is sometimes the only noticeable symptom (ANDERSON). Still there are symptoms which distinguish it from other continued fevers; for the pulse, instead of being full and strong, is small and weak, and rapid; the heat of the skin more ardent; and with such ranges of temperature as have been already noticed, these phenomena continue through the whole course of the disease. The fever, however, varies greatly in intensity, as already indicated, from a mere febricula to the severest forms of a typhoid type in protracted cases.

1. *Scarlatina Simplex*.

This form is known also by the names of *S. mitis* and *S. sine angina*. It is the simplest form of scarlet fever, and is limited to the fever and eruption, without any affection of the throat.

The symptoms of this variety are extremely mild, so that the patient is frequently not confined to bed. The primary fever, except that the pulse is rapid, is little more than a mere febricula, and is not aggravated on the appearance of the eruption. The eruption appears at the end of twenty-four or forty-eight hours,

and the crops follow each other according to the usual order of succession, appearing first on the face and neck and upper extremities; on the following day on the trunk; and on the third day on the lower extremities, when the disease has reached its acmé. On the fourth day the rash begins to decline, and fades from the face, neck, and upper extremities; on the fifth day it disappears from the trunk; and on the sixth or seventh day it is evanescent over the whole body. The colour of the rash is always more florid during the night than in the day, and on its declining desquamation takes place. With the disappearance of the rash the fever of this variety ceases, and the disease terminates; but it often leaves the patient in a state of considerable debility for several days, and may be followed by albuminuria.

2. *Scarlatina Anginosa.*

In this form of the disease the specific action of the poison is mainly limited to one region—that of the throat—the eruption on the skin being altogether wanting, or appearing at a later period than usual, generally by one day; and, as a general rule, is less copious and less diffused than in the other forms.

There is seldom a season in which scarlatina has been in any degree epidemic, that cases have not occurred in which patients (not having previously had scarlet fever) are seized with severe fever and sore throat, unaccompanied by any eruption, and who, on subsequent exposure to the contagion of scarlatina, have been found insusceptible of the action of the poison. Hence it is inferred that the disease they have passed through must have been a variety of scarlet fever, or *scarlatina sine eruptione*, making itself manifest by a peculiar sore throat, associated with the febrile phenomena.

This disease, therefore, essentially consists in fever and sore throat. It has been stated that the state of the throat is constantly in unison with the state of the constitution, and consequently this form of disease, according to its severity, assumes all the symptoms which accompany scarlatina simplex, or the more severe forms, with the exception of the absence of the eruption. It seems unnecessary, therefore, to give a separate detailed account of this variety.

In its milder form, the essential character is, that the secondary or specific actions of this poison fall on two tissues; on the skin,

and on the mucous membrane of the eyes, nose, mouth, and fauces. This form is liable also to the tertiary actions of the poison, but in what proportion of cases has not as yet been determined.

The fever which precedes the eruption in this form of scarlatina lasts from twenty-four to seventy-two hours. The symptoms, however, are more violent than in the preceding species; for nausea or vomiting, great restlessness, headache, and some delirium frequently occur as early as the second day. The heat of the skin also is more considerable, and often raises the thermometer as high as 105° , while the pulse is quick, feeble, and fluttering, and shows the extreme debility the poison has occasioned. The primary fever having lasted its period, the specific actions of the poison are set up, and the eruption runs the course which has been described in scarlatina simplex, but its colour is more intense, its duration more variable, and its attack more partial.

The *angina*, so marked a symptom in this affection, may precede the primary fever, may commence with the eruption, or may occur at some later day in the disease. It has many grades, and in this form of scarlatina they are all of the sthenic or inflammatory type. Thus, in slight cases the throat has merely the sensation of roughness, with some pain in deglutition; at a higher degree the tonsils are enlarged and ulcerated; while, in cases of still greater severity, they are swollen to a degree almost to occlude the fauces. In this latter case the act of deglutition is not merely painful, but in many instances impossible, and is impeded by a thick viscid mucus, which frequently requires the effort of vomiting to remove. The irritation of the fauces is sometimes propagated to the larynx, and the patient's voice is hoarse or inaudible, and perhaps he may ultimately die from this new affection. The parotid and submaxillary glands often enlarge, sometimes previously to the sore throat, more commonly about the fifth day, and again after the sore throat has healed.

The degree of fever is usually proportioned to the severity of the angina, and is accompanied by headache and sometimes by delirium. It does not abate on the appearance of the eruption, but continues till the throat is healed. If the sloughs come away early, or on the fourth or fifth day, the throat heals, and the fever

perhaps subsides within a day or two after the eruption. It sometimes happens, however, that the sloughs do not separate till the fourteenth or fifteenth day; and in this case the fever runs on with equal violence after the disappearance of the eruption, and the whole disease is sometimes prolonged for three weeks or a month. In this case the tongue may become brown, or dry, but it seldom continues so for more than a few hours. Observations as to temperature ought to be regularly and continuously made.

In the more severe forms of the *scarlatina anginosa* (and which have been described by some authors as the "*scarlatina gravior*"), the specific actions of the poison are the same as in *scarlatina mitior*, but the symptoms, both local and general, are more severe, and the tertiary affections more frequent, and, consequently, the disease is more grave and the danger more formidable.

The more remarkable symptom which distinguishes this form of the disease is the state of the tonsils. In the milder form, previously noticed, it has been stated that the tonsils are either slightly affected or greatly enlarged, of a bright red, and the ulcers comparatively superficial; but in this severer form the tonsil, though less swollen, is more gorged with blood, more livid in colour, while the ulcers are foul, deep, and burrowing; the secretions of the mouth, also, are more copious, and generally impregnated with the offensive sordes of the sloughs; while deglutition, if less difficult, is perhaps infinitely more painful, and the mouth often so tender that the slightest touch excoriates it. The ulcers likewise are slow to granulate, and only heal after a tedious treatment; and in the worst cases they spread in every direction, the parts tending to vesicate and even to mortify previous to the death of the patient.

The eruption also offers some peculiarities, being often later, by some hours, in coming out, its colour darker and more livid, its duration more uncertain, and its distribution more irregular and capricious than in the milder form. The primary fever likewise is usually longer, the delirium earlier, and the depression more complete than in the milder forms, and towards the close of the disease the tongue becomes brown, and the symptoms closely resemble those of the last stage of typhus fever.

Such are the more marked characters of the severer form of scarlatina; but it often happens that the progress of this disease

(unless the range of temperature is regularly and continuously recorded) is silent, slow, insidious, scarcely marked by any prominent symptom, till the degree in which the constitution is subdued by this formidable poison is shown by the inflamed nasal membrane discharging its fetid ichor, causing mortification of the alæ of the nose, or mortification of the lip or cheek ; or, it seizes on some remote part, as the toe, the leg, or the whole of a lower extremity, and which, for the most part, terminates the life of the patient. It may pass into the next form of the malady, namely,—

3. *Scarlatina Maligna*.

This form is that which is known as the “malignant sore throat,” or “putrid sore throat” of some authors ; and is the name now generally applied to certain cases of extreme severity, into which some of the forms already described may pass, as if by insensible gradations. In others, the violence of the attack is so sudden, that the patient is at once struck down by the force or virulence of the poison, the type of the attack being at once septic, adynamic, typhoid, and malignant. The extreme severity of the constitutional symptoms is marked by the smallness, feebleness, and irregularity of the pulse ; the oppressed, short, and quick respiration ; the appearance of early raving, stupor, and sometimes coma, alternating with fretfulness and violence, dullness and suffusion of the eyes, flushing of the cheeks, and dark brown furred tongue. The rash appears late, and is of uncertain duration, and soon assumes a dark or livid colour, or disappears in a few hours, and reappearing again after several days, if life is so far prolonged. Aphthous elevations in the throat, surrounded by a livid base, also become dark, and bursting they expose a surface of an excoriated dark gangrenous appearance. The passages of the fauces are always clogged up with much viscid mucus or phlegm, which produces a rattling noise in breathing, and increases the pain and difficulty of swallowing. The discharges, often sanious, are remarkably acrid, which issue from the nostrils and posterior nasal passages, causing soreness, excoriations, and even blisters on the surfaces and orifices over which, or through which, they flow. To this source the diarrhoea may be ascribed, which is sometimes severe at this period, and generally adds greatly to the sufferings of the patient.

The severity of the symptoms may produce death on the

second, third, or fourth day of the disease. Death frequently results from gangrene occurring in the course of the œsophagus or alimentary canal. In other instances in which the early symptoms were not remarkably severe, the aphthous state of the throat has all at once assumed a sloughing aspect, and has carried off the patient at the close of the first week. When the disease is continued beyond this time, death is foretold by the rapid, small, and weak pulse; by the rapid, languid, and oppressed respiration; frequent fluid acrid discharges issue from the bowels, and blood may be discharged from the nostrils, mouth, throat, bowels, or even from the kidneys; petechial or purpuric spots appear on the skin, and the patient is at last destroyed with local manifestations of the morbid state in several different parts and organs (CRAIGIE).

4. *Scarlatina Latens.*

The marked prevalence of anasarca in children has led to the discovery that such children have had previous attacks of scarlet fever, in such a mild form that it has escaped detection. In such cases the constitutional affection of scarlatina has been produced, with the development of the two principal or characteristic features of the poison only—namely, the eruption and sore throat. On the kidneys alone the poison makes itself felt, and the dropsy which ensues is more severe, complicated, and fatal than that which follows the regular forms of the disease (COPLAND).

Sequelæ of Scarlatina.—Under this head it is proposed to notice what may be called the “tertiary actions of the poison.” The effects produced in this way are often called by the people the “*dregs*” of the fever.

The principal source of some of these sequelæ is found to be, for the most part, the primary obstruction to which the functions of the kidneys are so liable.

Amongst the most important of these sequelæ are the effects produced by an extension of the original affection of the throat towards the internal ear, by the Eustachian tube. When this takes place it not unfrequently happens that the small bones of the ear are completely destroyed, the tympanic cavity becomes inflamed, ulceration of the membrane takes place, and perforation follows.

This morbid state is most difficult to remedy; a chronic dis-

charge from the ear is established, which is of a most offensive kind, and which may continue till the whole of the internal ear is involved in the destructive and inflammatory processes, till the delicate and soft tissues in the cochlea and semicircular canals are destroyed, and the petrous portion of the bone itself dies, till the mastoid process with its capacious osseous areolæ become the seat of an obstinate carious process; or even till the brain itself or the membranes are involved in the unhealthy inflammatory process. Such a combination of effects occasion great and protracted sufferings, and sometimes in the end, a fatal result (BRUCE, ANDERSON).

A similar inflammation may destroy the tissues in the back part of the pharynx, extending towards the base of the cranium and upper cervical vertebræ.

A frequent form in which the tertiary actions of the poison of scarlatina are manifested consists in inflammation of the joints, and dropsy; and it is singular that these diseases are more often set up after mild than after the more severe forms of this fever. In such cases, about the time of the disappearance of the rash, the joints of the wrist or fingers, of the knees or other articulations, become swollen and inflamed, and present all the phenomena of an attack of acute rheumatism. This affection keeps up the fever, and prolongs the whole duration of the disease for many days beyond the usual period.

Again, in a given number of cases, not exceeding three *per cent.* in general, but in different seasons, or under different treatment, sometimes amounting to twenty *per cent.*, the tertiary action of the poison produces dropsy. This affection usually occurs about the twenty-second or twenty-third day, or about the time when the patient is convalescent, and more often after a mild than after a severe disease. Dropsy more commonly begins with pallor of the countenance, and with œdema of the face; then the hands and feet swell, and, in a few cases, the areolar tissue of the trunk and lower extremities become enormously distended. When the areolar tissue is thus, slightly or more generally, distended with fluid, effusion may take place into the cavities of the head, chest, or abdomen. When the brain is threatened the effusion is commonly preceded by the usual hydrocephalic headache, by convulsions, and sometimes by blindness. Effusion into the cavity of the chest or of the abdomen

causes the usual symptoms of hydrothorax and of ascites, which have been described. In the former instance, however, the watery fluid is sometimes poured out so rapidly as to destroy the patient in a few minutes or in a few hours.

The first appearance of the cedema, whatever form of dropsy may follow, is usually preceded or accompanied by an accelerated pulse, by the urine being scanty, commonly turbid, and passed with pain: the quantity, however, is shortly increased; and if examined when passed copiously, it is found to be of low specific gravity, or from 1·011 to 1·017, and to contain albumen, sometimes blood, renal epithelium, and cylinders.

Diagnosis.—The only diseases with which scarlatina can be confounded are the acute forms of roseola and measles. Roseola, though usually accompanied by fever and sore throat, is distinguished from scarlatina by the eruption being confined generally to the chest. The diagnosis between measles and scarlatina will be better understood after the next disease we have to notice has been described—namely, the hybrid form sometimes assumed by a concurrence of the two diseases; and by a careful study and observation of the ranges of temperature in each.

Cause and Propagation of the Disease.—The earliest source of the poison is distinctly traceable to Arabia; and the disease has now spread over the whole world. It prevails at all seasons of the year, is always in existence somewhere, and often epidemic. Scarlet fever has been found to spread more extensively, and with greater fatality, among the poorer than among the wealthier classes of society. Both sexes are attacked in nearly equal proportions. All ages are probably liable to the disease; but it is most common to childhood; the feebleness of this early period of life facilitating, perhaps, the reception of the poison, and as children grow older, the less liable are they to be attacked.

In a clinical essay on the *History of Scarlet Fever*, most carefully worked out by Dr. B. W. Richardson, it is shown that scarlet fever attacks most frequently in the third and fourth years of life. The chances of attack decline rapidly after the fifth year. The seasons also seem to influence its prevalence and intensity. The months of October, November, and December, furnish in England the maximum amount of the disease—the months of April, May, and June, the minimum. This disease being estab-

lished, the patient generates a poison which may be communicated directly, or which may contaminate the atmosphere. The disease is eminently communicable, so that no susceptible person can remain in the same room, and hardly in the same house, without contracting it. The *infecting distance* is consequently much greater than in typhus. Indeed, it is necessary to break up every academic establishment in which scarlatina prevails; for it is hardly possible to isolate children in the same house or school, however large, so as to prevent the disease from spreading. That scarlatina is capable of being directly communicated is shown by the fact that children have been inoculated with the serum found in the vesicles which sometimes accompany the rash, and have taken the disease; but the inoculated disease not having proved milder than the natural, the practice has been properly abandoned. Another proof of the directly communicable nature of scarlatina is, that it has often been propagated by *fomites*, as by the clothes and boxes of boys returning from school. Susceptible persons also sleeping in a room lately occupied by patients labouring under scarlatina, and before the furniture has been washed and the bedding and walls well ventilated, have often taken the disease. The virus is destructible by heat at the boiling point, or it may be disinfected artificially.

Dr. Willan says, that out of 2,000 cases that he attended, he witnessed no instance of a *second attack*. Still, there are some exceptions to the statement, that an attack of scarlatina gives an immunity from a second attack. Dr. Binns has seen instances of scarlet fever occurring twice in the same person, while Sir Gilbert Blane met with an instance of its occurring thrice in a young lady, without the least suspicion of ambiguity or possibility of mistake in diagnosis. Dr. B. W. Richardson shows that it may recur once or even twice in the same person. But these events are rare; and death from a second attack is unknown as a fact.

Scarlet fever has often co-existed with the vaccine disease and with erysipelas, and this poison is consequently capable of co-existing in the system, not only with those that have been mentioned, but probably with all other morbid poisons.

The poison of scarlatina is absorbed by the mucous membranes; and absorption is also evident from the fact of inoculation having been effected through the skin. Children have been born labouring under this disease.

The period of latency varies from a few hours to ten days. In one case inoculated by Rostan the disease appeared on the seventh day; and the specific poison is probably capable of communication from the patient to others as soon as the primary fever has formed, and perhaps continues to be so till the sore throat has perfectly healed, supposing that affection to continue after the eruption has died away.

Prognosis.—The mortality from scarlet fever varies greatly according to the season, and also, perhaps, according to the *treatment*. In some years the proportion of deaths is not greater than three per cent.; but Sir Gilbert Blane says his practice gave one in four. He was consulted probably only in the worst cases, for in the same year it appears, from the reports of other practitioners, the deaths varied from one in six to about one in thirty, according to their different modes of treatment.

There is perhaps no disease in which the progress is so capricious: for it is found to vary with the several forms, types, complications, epidemic constitution, and with the treatment in a most remarkable degree. The mortality is greatest in the period of infancy and childhood—from one to five years. In relation to mortality, it seems second in this country as to severity, typhus fever standing first (RICHARDSON). It is twice as fatal in towns as in the country. "There is one condition in which the disease is almost invariably fatal; that is the puerperal state. No precaution ought, then, to be neglected, no precaution ought to be thought excessive, which tends to prevent a woman from receiving the poison of scarlatina while pregnant or recently delivered" (DR. ANDREW ANDERSON). Fever during the pregnancy most certainly ends in abortion and death. If the woman be recently delivered, the disease will be of the most malignant type, and almost always fatal.

Treatment.—Scarlet fever being evidently accompanied by many highly inflammatory symptoms, the practice of bleeding was adopted on the first breaking out of the disease, in all countries, and according to Willan, *with the most disastrous results*. This mode of treatment was adopted by Morton; and he speaks of witnessing 300 deaths from scarlatina in a week. It prevailed also down to the time of Huxham, who abandoned it and introduced a treatment by bark. In this manner an entirely opposite system of treatment has been gradually introduced, and the

records of medicine enable us to state the results of these opposite modes:—Of cases treated at the Foundling Hospital by bleeding in 1786, and of cases treated at the London Fever Hospital in 1829, in the same manner, it seems proved, that one in six died after bleeding, while only one in twenty-two died after a milder, if not a directly opposite, mode of treatment; and the conclusion which inevitably follows is, that the chances of recovery are diminished by the practice of bleeding nearly in the ratio of four to one as compared with the chances of recovery supposing the patient not to have been bled. It remains now to give some general directions for the treatment, and to point out the circumstances in which bleeding, purgatives, wine, and tonics may be most advantageously employed.

It should be laid down as a maxim that in scarlatina, medical advice ought always to be had recourse to; for the worst cases we meet with (as those in which mortification of the nose, cheek, or limbs sometimes takes place) are those in which the disease has, from its apparently mild character, been left to itself.

In the mildest form of the disease, it is often sufficient to confine the patient to the house; to enjoin strictly a milk diet; to regulate the bowels; and, above all things, to avoid the *nimia diligentia medicorum*. If anything more be done, a small quantity of wine and water, proportioned to the age of the patient, is the best. The disease thus treated is uniformly mild, and when the rash declines the fever subsides, complete defervescence advances in due course, and the disease is at an end.

A gentle emetic at the outset is believed by physicians of great experience to have a happy effect in modifying the future course of the disease. Ipecacuanha with tartar emetic is the best form for administration.

Looking also to the morbid condition of the blood, and to the tendency which exists to the deposition of fibrine in the right cavities of the heart, small doses of *carbonate of ammonia* (three to seven grains) administered every hour, or every three hours, as soon as the symptoms are decided have been recommended (PEART, WITT, RICHARDSON). Or the *liquor ammoniæ acetatis* may be used with an excess of ammonia, to the amount of from three to five drops of *liquor ammoniæ* added to two fluid drachms of the former in a liberal quantity of distilled water (RICHARDSON). It is important to administer these medicines in small and

frequently repeated doses; and, if possible, to let the remedy be taken as a drink.

The treatment of the milder forms of the fever, or when the tonsils are considerably enlarged, is first to tranquillize the stomach and allay its perverted action when vomiting exists, either by small doses of the sulphate of magnesia, or by the effervescing draught,—medicines which, according to the state of the bowels, may be exhibited every four or every six hours. As soon as this object is effected, and it is ascertained that the tonsils are greatly enlarged and swollen, the practice (supposing the patient to be *an adult*) is to relieve them by a local bleeding, and six to twelve leeches may be applied to the throat, and allowed to draw freely; and this bleeding may be further encouraged by the application of a poultice. The trifling loss of blood thus sustained does not impair the general strength of the patient, if it is done sufficiently early, while it greatly reduces the swelling of the tonsils, and may prevent them becoming permanently enlarged. Another advantage is also gained by the application of leeches to the throat—namely, that they relieve the affection of the head; for we constantly observe that in diseases depending on morbid poisons, the head symptoms are relieved by relieving the part specifically acted upon.

The tonsils having been thus relieved, the fever ought to be permitted to run its course uninfluenced by medicine; the patient being only refreshed by the occasional administration of the saline draught, so grateful to his parched mouth and feverish state. If stimulation be adopted in these cases we are apt to bring back the tumefaction of the tonsils; while, on the contrary, if we take more blood, we hazard producing the more serious accidents incident to scarlatina. The medicines, therefore, that have been mentioned should be persevered in till the disappearance of the eruption, and till the healthy granulations of the throat, and the decline of the fever, give certain evidence of a state of convalescence. At this point, perhaps, some mild tonic medicine is desirable, and prepares the patient once more for the fullest enjoyment of health. This is the most successful treatment of scarlatina in its milder forms. With children, however, it is better to trust to the soothing effects of warm poultices round the throat, than weaken the child by loss of blood.

The severe forms are characterized by the less swollen state of

the tonsils, and by their being more livid and gorged with blood; by the ulcers being deeper and more spreading; and by the slough being fouler than in the milder varieties. As there is a greater tendency of parts to run into mortification, the necessity of adopting a more stimulating plan of treatment, and one more calculated to support the powers of the constitution, is manifest, and experience has shown this view of the case to be correct. The administration of wine should therefore be the basis of the treatment of such cases. The quantity of wine for an adult may be from four to six ounces in twenty-four hours, and for the child • about half that quantity. The wine may be either port or sherry, and should be drunk in small quantity, mixed with two-thirds water; or it may be given with sago, arrow-root, jellies, or other slops. The earlier the wine is given in the disease the better, and when delirium does or does not exist; regardless, also, as to whether the tongue is moist and white, or brown and dry; and it should be continued till the patient is decidedly convalescent. While pursuing this plan, it is necessary that the patient's bowels should be attended to. The treatment by wine is often extremely successful; and, as it is in general pleasant to the patient, whether a child or an adult, it is seldom refused. In cases more severe brandy may be required, or carbonate of ammonia in liquor cinchonæ, chlorinated soda, or creosote.

It may be proper, before adopting any special continuous mode of treatment, to follow the emetic first given by a dose of calomel, as a purgative, and this especially with children, to be followed in six or seven hours by a dose of castor oil or magnesia; and the bowels are ever afterwards to be kept open by remedies suited to the state of the patient and the nature of the disease. The following are the principal indications which must guide the treatment:—If there is much excitement of the system, depleting cathartics are to be given; if nausea and vomiting prevail, a seidlitz powder is of service. If the discharges from the rectum are acrid and acid, with acidity of the stomach, magnesia is preferable; if there is abdominal pain give castor oil with opium (WOOD).

The treatment of the tertiary affections of the poison may be very various. Thus the affection of the larynx is one of the most important; and it is singular, that although this affection would seem to be of an inflammatory character, yet bleeding is not

successful in combating it; on the contrary, the most beneficial mode of treatment appears to be, that of moderately supporting the powers of the patient by wine and mild tonics.

Again, when the synovial membranes inflame, and the joints become enlarged and swollen, all stimuli should be withdrawn; but bleeding, in this instance, appears unnecessary; a moderate action, however, of the bowels should be kept up by means of the sulphate of magnesia, with camphor mixture, or carbonate of ammonia; and, if pain be severe, some sedative should be added, as the tincture of hyoscyamus in a dose of fifteen minims.

The more formidable affection in scarlatina is dropsy; and from the great tendency to effusion into the head and chest, an active treatment is necessary. We should have imagined that in dropsy, a symptom in most cases of great debility, and following a disease whose characteristic is great depression, bleeding would have been dangerous and improper; but experience has shown that bleeding by leeches over the region of the kidneys is often of service, especially if cedema appears in the face and is accompanied by headache, some blood should be taken, from two to four ounces in the child, and from four to eight ounces in the adult. The good results of cupping are also very remarkable; and even of continuously hot poultices over the lumbar regions, when it is not thought advisable to take blood. By these means the renal congestion is relieved, and the urine becomes more copious and less albuminous.

Diaphoretic doses of antimony, and moderate but not severe purging may be had recourse to. The choice of the purgative must rest with the practitioner; but the compound powder of jalap, or the bitartrate of potash alone in drachm doses three times a-day are among the most useful; or it may be given as an electuary in which the *cream of tartar* is mixed with nearly an equal quantity of *honey*, *treacle*, or *marmalade*, and flavoured, if necessary, with a few drops of peppermint oil; digitalis also is much recommended, but it does not appear to possess any specific virtue. Dr. Andrew Anderson recommends also the use of mercury in the form of blue pill given twice or thrice daily, with squill and digitalis, till the urine resumes its natural appearance. The patient must at the same time be well fed; and preparations of iron may be given with advantage. The *muriated tincture* seems to have the best reputation; and the *iodide of potassium*

in small doses is also useful. With this latter remedy the *syrup of the iodide of iron* may be combined if it is desirable to continue the *chalybeate* (Dr. A. ANDERSON).

Blisters have been much recommended as a means of relieving the throat, but their value is not yet determined. Some writers speak of mortification of the parts, and even death, following their application, while others consider them as powerful auxiliaries. As a general rule they are unnecessary, and are better omitted; since the irritation they occasion may predispose the cervical glands to the tertiary action of the poison.

Gargles are unnecessary for children, for they cannot gargle; but they are of the greatest service, especially the deodorizing gargles or washes, when the patient can be taught to use them. A weak solution of chloride of lime, or of chlorine water, or of Condry's fluid, or of the permanganate of potash, is well adapted to such a purpose. But the following is recommended by Dr. Richardson as the most effectual gargle:—

Solution of peroxide of hydrogen (containing ten volumes of oxygen), six ounces; tincture of myrrh, an ounce; rose water, five ounces.

This gargle may be used at pleasure; it is said to be refreshing to the patient, and removes the offensive secretions readily. In the case of young children who are unable to use a gargle, the throat may be washed out, by holding the little patient with the face downwards, and by pumping the solution over the surface of the fauces through a bit of gum catheter from a double acting india rubber bag. (Richardson, *Clinical Essays*, p. 110.) As an invariable routine practice, Dr. W. T. Gairdner strongly recommends that "*the patient inhale the steam of hot water from the beginning to the end of the fever; as long at least as the throat is sore.*"* In slight affections it is sufficient to employ infusion of lintseed in water, acidulated with nitro-muriatic acid, weak solutions of alum, nitre, or common salt. When membranous diphtheritic patches are observed on the fauces, and the colour of the mucous membrane is of a dark red, capsicum infusion or powdered red pepper is an excellent application (WOOD), and in children

* Inhalers for the purpose may be had of Mr. Young, surgical instrument maker, 58 North Bridge, Edinburgh; Mr. W. B. Hilliard, of Glasgow; and of Mr. Matthews, 9 Portugal Street, Lincoln's Inn Fields, London; and most other surgical instrument makers.

who cannot gargle, it may be applied with a hair pencil. Solution of zinc or nitrate of silver are also of service.

These details are given because the physician must decide, upon the merits of the individual case, the nature of the treatment he will adopt. But it must be remembered that cases of scarlet fever, if left to themselves, with rest and careful nursing, will generally get well. The mere intensity of the fever is no ground for active interference by way of treatment, if the pulse is full and of good strength. Much is to be trusted to the shortness of the fever, remembering that there is no disease in which the patient is more apt to be delirious, with less danger, than in scarlatina. (W. T. Gairdner, *Clinical Medicine*, l. c.)

Dietetic and Preventive Treatment.—The diet of the patient should be slops, light nutritious broths, and jellies. Fumigation will not, it should be remembered, destroy the miasmata in the sick room; and consequently, the doctrines of cleanliness, of ventilation, and of separation, are as imperative in this disease as in typhus or small-pox. We cannot disinfect the walls of the chamber, nor the clothes of the patient, except by washing them, or exposing them to a dry heat exceeding the boiling temperature. In general, then, the chamber where the sick patient has lain should be white-washed and well scoured after the disease has subsided, before any person susceptible of the poison be allowed to sleep in it. It is important to guard against cold during convalescence. Children are not safe till the desquamation of the skin shall have been thoroughly accomplished—till all the old cuticle has been removed, and till the skin has resumed its natural softness. Therefore keep the patient in bed till convalescence is perfectly established; and subsequently insist on his being confined to his room till desquamation is complete. If the whole surface of the body is well rubbed over once or twice a-day with common olive oil, the irritation of the skin will be soothed, and the process of desquamation facilitated; and as soon as the child has strength to bear it, he may have a warm bath every second night, in which he may be well rubbed over with oatmeal and bran.

The ears of patients suffering from scarlatina ought also to be carefully watched; and any complaint of pain ought at once to suggest an examination of the ears. A leech or two and warm poultices, followed by blisters if necessary, may subdue the lesions

of the ears which are apt to supervene. No stimulating applications should be used, beyond the frequent syringing with warm water (DR. ANDREW ANDERSON, l. c.)

Different prophylactic medicines have been recommended; amongst which belladonna has had the greatest number of advocates, but its value has diminished greatly, as the weight of testimony is against its possessing any prophylactic virtues (WOOD).

HYBRID OF MEASLES AND SCARLET FEVER—*Rubeola* or *Rötheln*.

Definition.—*A specific eruptive disease, preceded by, and accompanied with fever, watery discharges from the eyes and nose, sneezing, and sore throat. The eruption appears on the third or fourth day, and consists of crimson stigmata, rapidly running together into patches of an irregular shape, with obtuse angles, and of sizes varying from a threepenny to a crown piece, according to the severity of the case. The eruption continues from six to ten days, and terminates in desquamation by furfuraceous scales.*

Pathology.—Those diseases now fully considered in the previous pages,—namely, small-pox, measles, and scarlet fever, have been by some nosologists termed exanthematous diseases, in consequence of their principal phenomena being a very marked eruption.

The Arabians first described them and considered them merely as varieties of one and the same disorder. Many essential differences, however, were soon observed to distinguish the small-pox; but the points of resemblance between measles and scarlet fever were so many that it was not until fatal accidents had occurred from the great error of confounding them, that their differential characters were remarked, and their separate identity established. Now it is a generally received doctrine that measles and scarlatina, in their essence and in their symptoms, present two well-defined states of disease. This is, indeed, one of the most indisputable facts in Pathology. By Schönlein, measles has been classified as a peculiar exanthematic form of catarrh; while scarlatina is placed amongst the group of erysipelalous diseases; while, according to the experience of Dr. Küttner, of Dresden, there are “Androgynous” cases calculated to embarrass the most experienced “diagnostiker.” The measles and scarlet fever were especially confounded under the common name of *morbilli*; and

even as late as the middle of the eighteenth century, writers of the highest repute supported the identity of measles and scarlet fever (the morbilli confluentes of Sir William Watson). All authors before Sauvages (1768) had used the term *morbilli* (the term now in use) to designate measles; but he adopted a new name, and called measles by the designation of “rubeola,” an innovation which has caused much confusion, having been adopted by some (such as by Willan and Bateman) and rejected by others. Hildebrand, following the old nomenclature, calls measles *morbilli*, and scarlet fever *scarlatina*; and terms the disease now about to be considered *rubeola*, as has been done by Dr. Copland. The German authors call it *rötheln*, and by this name it was first described by a most distinguished and learned Scotch physician, Dr. Robert Paterson, of Leith, in 1840. He is the only physician in this country who has given an original description of the disease in the English language, his description of the disease being drawn from many cases of it which occurred in his practice.

A difference of opinion prevailed amongst authors as to whether or not this disease is of a distinct and specific form. Those who have most recently described it (Hildebrand, Paterson, and Copland) consider it to be a disease possessing characters common to both measles and scarlet fever, as well as characters peculiarly its own. In truth, it seems to be a hybrid disease, developed from combined poisons of the two fevers, measles and scarlet fever. Dr. Küttner, of Dresden, also states that he has seen occasionally in the same individual portions of the skin presenting the scarlatina eruption, while in other parts the eruption of measles was to be seen. He thus recognized not only examples of transition, but he recognized cases which may be termed hybridous. (*Dublin Hosp. Gazette*, 15th Dec., 1858; and Ranking's *Abstract*, vol. xxix., p. 20.) The following description of this hybrid disease is condensed from Dr. Paterson's account:—

Symptoms.—The febrile stage of the disease varies, like all the diseases already noticed, not only in the severity of the symptoms, but also in the length of the attack when compared with scarlet fever. It usually commences with rigors, not severe, but continuous. More or less cough soon makes its appearance—of the same clanging nature which is observed in the febrile stage of true measles—and is very shortly accompanied with itchiness, redness, and weakness of the eyes, lachrymation, frequent

sneezing, and watery discharge from the nose. In persons more advanced in life, severe frontal headache is complained of, together with rheumatic pains, more especially in the muscles of the back and chest, nausea, and sometimes vomiting, together with constant drowsiness. The skin is hot and dry, with the pulse above the natural standard.

A greater or less number of these symptoms is always noticed, but, in addition, sore throat is a most constant one. This, in some cases, is extremely slight, amounting only to a roughness of speech, and trifling difficulty in swallowing; but in others it goes on to severe inflammation of the *tonsils*, *velum pendulum palati*, and surrounding parts. This last inflammatory affection is, however, more severe during the eruptive stage. The sore throat is one of the most characteristic features of the disease, occurring in the slightest and most gentle cases.

The odour given forth by patients under this disease is described by Dr. Heim, of Berlin, as similar to, but stronger than that which scarlatina patients emit, and has been likened to the smell of a place where fish is kept—in short, fishy.

When the febrile state now described has continued for three or four days, the appearance of an eruption is sudden and general. It breaks out all at once over the whole body, and consists of bright and thickly set stigmata, which appear on the trunk, but are more sparingly dispersed over the face and extremities. It assumes different aspects and degrees of confluence according to the severity of the case. Its first appearance resembles measles, but the stigmata rapidly run together, and soon assume an irregular shape, with obtuse blunt angles. These irregular patches are of an intense red colour towards the centre, being gradually shaded off towards the margins, which approach in colour that of the surrounding skin. The size of the patches in ordinary cases seldom exceeds a sixpenny piece; but in the severe forms of the disease they run still further together, and are to be seen of the size of a crown piece. In such cases, which are usually of a malignant nature, the whole body may be covered over with patches, varying from the size of a sixpenny piece to a crown piece, thickly set together, and of an intensely dark colour towards their centres. The eruptive patches are felt to be distinctly elevated above the skin, some more than others, and always greatest in the centre of the patch.

During the continuance of the eruption, the general symptoms already described are usually aggravated, and not unfrequently new symptoms are superadded. The sore throat becomes much worse. The hoarseness becomes so great as frequently to cause entire loss of voice, and generally more or less external tumefaction of the throat takes place. In severe cases this is great, and is accompanied with much redness and swelling of the throat internally. There is a total inability to swallow even the slightest portion of fluid, which generally regurgitates by the nose. A large secretion of mucus of a vitiated nature takes place, the cough is constant, and is rendered doubly severe by the state of the throat. The pulse is very frequent; the skin hot and dry; and there is great restlessness, expressed by children tossing the head frequently from side to side, accompanied with frequent starting; and they are sometimes seized with convulsions. It is in this stage, in the worst forms of the disease, that death generally occurs, and that by coma. It may, however, take place either by suffocation from the large quantity of vitiated mucus, or by convulsions and subsequent coma.

Vomiting is an occasional symptom during this stage, and like convulsions is sometimes seen in mild cases of the disease in children.

The eruption in mild cases, in general, continues distinct for from four to five days, during which time the other symptoms are going on favourably, becoming gradually milder as the period of the decline of the eruption draws near. In severe cases, however, the rash keeps its bright colour and distinct form for a much longer period—*e. g.*, six, eight, or ten days.

The termination of the eruptive stage is, in some instances, marked by what is termed a distinct crisis,—such as the occurrence of copious sweating, deposits from the urine, diarrhoea, and epistaxis. Most commonly, however, there is no such crisis, but the eruption gradually fades and the disease subsides.

As this happens, the desquamation by furfuraceous scales gradually ensues. This event is indicated by the appearance of scales towards the centre of the patches of eruption, to the margins of which they gradually extend, and soon spread over the whole body. The scales are small, and not unlike those of measles. On the hands and feet the scales are larger, but never reach the size of those of scarlet fever.

Lesions seen in Fatal Cases.—The accounts of these are few in number. They vary according to the period of the disease at which death occurs. Death most frequently happens during the eruptive stage, from coma, or from the affection of the throat and lungs. No morbid appearances of a uniform nature can be observed, connected with the mode of death by coma; but when death happens from pulmonary oppression, the lungs are found much congested, the mucous membrane of the bronchia injected, with a copious mucous secretion. The throat presents very similar appearances to those which are seen in scarlatina, great tumefaction, and dark coloration of the membrane lining the throat, dark aphthous spots, and large quantities of vitiated viscid mucus.

Diagnosis.—The accompanying febrile symptoms at once distinguish the disease from roseola, as also do the peculiar characters of the eruption. The only other affections with which it may be confounded are measles and scarlet fever. The following table, modified by Dr. Paterson from the description of Dr. Heim, of Berlin, points out the diagnostic marks more clearly by contrast than can otherwise be done, and shows that rubeola, röteln, or the mixed disease, has every right to be considered as a distinct affection:—

TABLE SHOWING THE MOST PROMINENT DISTINGUISHING CHARACTERS OF SCARLET FEVER, RUBEOLA, AND MEASLES.

SCARLET FEVER.	RUBEOLA OR RÖTHELN.	MEASLES.
<i>Symptoms of First Stage, or Premonitory Fever.</i>		
Rigors; nausea; sometimes vomiting, thirst, and heat of skin; with sore throat, hoarseness, and delirium, in the anginoæ variety of scarlatina.	Shiverings; nausea; rarely vomiting; itching; redness and pain of the eyes, with increased flow of tears; sneezing, and watery discharge from nose; cough, sore throat, and hoarseness.	Rigors; nausea, and sometimes vomiting; frequent starting during sleep; itching; redness; pain of eyes; watery discharge from eyes and nose; sneezing; harsh cough.

Duration of Premonitory Fever.

Premonitory fever is of short duration; the eruption most generally making its appearance on the second day.	The eruption generally breaks out on the third or fourth day, so that the premonitory fever is prolonged over that time.	Eruption makes its appearance towards the close of the third, or beginning of the fourth day.
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SCARLET FEVER.

RUBEOLA OR RÜTHELN.

MEASLES.

Appearance of Exanthematous Eruption.

It first appears in innumerable red dots or points, being at first of a pale red colour, soon acquiring a deeper tint, and at last giving the affected portion of skin a uniform red appearance.

The rash appears in minute dots, and rapidly assumes the appearance of irregular - shaped patches, with obtuse angles, varying in size from that of a threepenny to much larger than a crown piece. The red rash is gradually shaded off with the surrounding skin.

The rash appears in minute red points, like flea-bites; several of them soon coalesce, and form rounded masses, irregular - shaped crescents, or semicircular patches.

Roughness or Elevation of the Affected Skin.

There is a perceptible roughness in the skin affected with scarlatina. It is in general most evident on the breast and extremities, and seems to consist of the enlarged papillæ of the skin.

In this disease, more especially in the severer forms of it, the patches of eruption are distinctly and considerably elevated, and more especially towards the centre of the patch.

The elevation of the patches of eruption in measles is slight; though in general distinct in the worse cases, they are certainly not at all elevated as a rule.

Part of Body First Affected.

The efflorescence is first perceptible on the face, neck, and chest, gradually passing downwards, and becoming diffused over the whole body.

The efflorescence first appears on the trunk of the body, the whole of which it at once occupies. It is always more sparingly seen on the extremities, but seems to break out there at the same time as it does on the trunk.

The efflorescence first appears on the forehead and among the roots of the hair, and spreads slowly and successively over the neck, chest, trunk, and extremities.

Duration of the Eruption.

The eruption remains present three days; begins to disappear on the fourth day; and is almost entirely gone by the termination of the fifth day.

In the rütheln the duration of the eruption seems to depend upon the severity of the disease: in mild cases remaining out four or five days, and in bad cases, six or ten days.

In this disease it remains out three days.

Symptoms accompanying the Eruption.

The symptoms which accompany the eruption in each of the three diseases are quite the same as those of the premonitory fever. It is proper here, however, to remark, that it is only in the anginose and malignant varieties of scarlatina that we have sore throat, there being little or none in the simple scarlatina, while in the mildest kind of rütheln this is always a prominent and troublesome symptom.

SCARLET FEVER.

RUBEOLA OR RÖTHELN.

MEASLES.

Desquamation.

The cuticle in this disease is thrown off in patches of considerable size, the largest being from the hands and feet.

The desquamation of rubeola consists of minute portions of cuticle like scales of fine bran.

The desquamation always begins towards the centre of the eruptive patch, and gradually extends to the circumference.

The desquamation of measles consists of minute portions of cuticle, like scales of fine bran.

Sequelæ.

Anasarca is the most common sequela of scarlet fever. It is extremely common, and most frequently occurs after the mildest cases; swelling and suppuration of the cervical glands is also common.

"I have noticed one case of dropsy after a mild, though well-marked attack of this disease; swelling and suppuration of the cervical glands also frequently takes place" (DR. PATERSON).

Affections of the lungs and pleura; tedious distressing cough; chronic bronchitis; pneumonia, tubercles; gangrenous inflammation of cheeks, gums, lips, genital organs, &c.; dropsy occasionally occurs, but very rarely; diarrhoea is very common after some epidemics.

Prognosis.—It requires to be as guarded as in scarlatina; for, like scarlatina, rubeola is often an extremely and rapidly fatal disorder. The greater or less acuteness of the premonitory fever generally affords us a means of judging as to the probable severity of the eruptive stage; and in general it is a mild disease. To have a copious secretion of mucus in the back of the throat is always a bad symptom, or regurgitation of fluids by the nose. The chest ought to be examined from day to day, as sudden inflammatory action is apt to be established, and often it rapidly proves fatal. The condition of the urine requires also to be daily investigated.

Treatment.—The treatment is similar to that of scarlet fever. The functions of the skin are if possible to be stimulated, and Dr. Paterson found that the *aqua acetatis ammoniæ* in the proportion of two ounces to half an ounce of antimonial wine and four ounces of water, made into a mixture, was the most useful agent. The use of colchicum was also had recourse to with decided benefit.

DENGUE—*Scarlatina Rheumatica*.

Definition.—*A peculiar febrile disease, conjoined with sudden severe pains in the small joints, which swell; succeeded by general heat of skin, intense pain in the head and eyeballs, and the appearance of a cutaneous eruption on the third or fourth day. The disease is infectious, with an epidemic tendency.*

Pathology.—The chief peculiarity in this disease is that it seems to combine an exanthematous eruption ushered in by fever, with a rheumatic or neuralgic state; and the course of the malady is so divided by intervals and remissions as to give one the idea that relapses are of frequent occurrence in its course. It has been chiefly prevalent in Rangoon, Calcutta, Berhampore, Patna, Benares and Chunaighur in the East Indies; the island of St. Thomas in the West Indies; the Southern States of America; the ports on the Gulf of Mexico; the towns of New Orleans, Savannah, Charleston, Philadelphia, and New York. It was epidemic in America in 1824-28, and nothing appears to have been heard of it again till 1847 and 1850, when it again visited the Southern States. An epidemic of this disease has been recently described by Lemmon as having occurred in Virginia. (*Amer. Med. Times*, Feb. 16, 1861.) It is not known as an epidemic disease, at least in Great Britain; and the account of it here given is nearly in the words of Dr. Wood. It has also been described by Twining, Mouat, and Goodeve. Dr. Richardson, in his admirable *Clinical Essays*, notices the circumstance that we not unfrequently meet with "scarlet fever connected with acute rheumatic fever; and he ascribes the first notice of this connection to Dr. Golding Bird. Subsequently the circumstance was noticed by Dr. Kelso, of Lisburn, and by Dr. Ross. Dr. Andrew Anderson, also, in his *Lectures Introductory to the Study of Fever*, notices that rheumatic pains of the arms and legs, often very severe, connected, as he supposes, with the poisoned state of the blood, are not unfrequently met with. Lastly, Dr. Richardson himself records the cases of four children, in which the rheumatic state combined with scarlatina was distinctly expressed (*Clinical Essays*, p. 85); and Dr. Wilks has noticed similar cases.

Symptoms.—In the greater number of cases the first symptoms have been headache with intolerance of light, restlessness, and more or less chilliness, debility, pains in the back, the limbs, and

joints. The small joints swell, and there is soreness with stiffness of the muscles. The skin soon becomes hot and dry, the pulse frequent, the face flushed, and the eyes red and watery. The tongue though red is usually clean. A rash or papular eruption sometimes appears, though not generally at this stage. Painful swellings in the lymphatic glands of the neck, axilla, and groins are common. The testicles also swell, and continue so till the subsidence of the other symptoms. The febrile state lasts from twelve hours to three or four days, after which it subsides, leaving the patient very feeble. This remission lasts for two, three, or four days, when a return of the fever and pains, with a thickly coated tongue, nausea, and epigastric tenderness mark another phase of the disease. On the fifth, sixth, or seventh day the eruption appears in the form of a scarlet efflorescence on the palms of the hands, which spreads rapidly over the body, and gives relief to the symptoms of febrile irritation. The eruption is extremely variable in character, being sometimes smooth, red, and continuous as in scarlet fever, sometimes in patches, rough, and of a dark hue as in measles, and occasionally either papular, vesicular, pustular, or furunculous, often with a mixture of two or more of these forms. The complaint gradually subsides, and leaves the patient with some rheumatic stiffness or soreness for a longer or shorter period, with feelings of weakness and mental depression. The duration of the affection varies with the length of the remission; but on the average is about eight days. Decided implication of the mucous membrane of the mouth and throat prevailed in the last epidemic in Calcutta, with an almost entire absence of the articular pains.

Treatment.—Palliation and alleviation of symptoms, as they arise, chiefly by opium and alkaline remedies; following the indications given under Scarlatina and Rheumatism.

ERYSIPELAS—*Erysipelas*.

Definition.—*A febrile disease, associated with a peculiar eruption of the skin, and the inflammation which attends this eruption is apt to spread, and very commonly involves the areolar tissue beneath.*

Pathology.—As in other diseases of the miasmatic order, it is believed that in erysipelas a specific disease poison is absorbed

and infects the blood, and that after a given period of latency it produces generally, but not constantly, the phenomena of fever, which sometimes terminate in inflammation of the membranes of the brain. The specific action of the poison, however, is mainly made manifest by inflammation of the skin and subcutaneous areolar tissue, which runs a definite course. The inflammation is of a peculiar nature, not yet clearly understood.

This disease is treated of by almost every writer, medical or surgical, from the time of Hippocrates; but there is no circumstance connected with its history that would justify particular mention in an elementary treatise: In Scotland it is known by the name of the *Rose*, in England it is sometimes called *St. Anthony's fire*.

The rule that the poison occasions primary fever has many apparent exceptions, especially in traumatic erysipelas commencing in slight wounds, as leech-bites, or trifling punctures of a dropsical leg or scrotum. Idiopathic erysipelas is, however, very constantly preceded by fever,—eighteen times out of twenty; and the affection of the areolar tissue may be trifling, but it is seldom altogether wanting.

The pathological phenomena which result from the action of the poison on the skin are, first, that the cutis is diffusely inflamed, the affected part being either of a bright scarlet or a rose-coloured tint, evanescent on pressure, but returning on that pressure being removed. This inflammation is usually of great extent, occupying very commonly the whole face, head, and neck, or a considerable portion of the trunk, or one or both lower or upper extremities. It runs a course which may be characterized as “tolerably regular and definite.”

This inflammation of the skin may terminate by resolution, by vesication, or by gangrene. When it terminates by resolution, the rose tint gradually changes to a deeper and more venous hue, and at length fades away, leaving the skin of its natural colour, but with the texture so impaired that desquamation follows. If the inflammation terminates in vesication, the cuticle is raised into a number of vesicles of greater or less size, and sometimes into large bullæ or bladders containing a yellowish transparent serum. The cuticle at length ruptures, the fluid is discharged, and a crust sometimes forms, which, on falling off, leaves the skin underneath either sound or superficially ulcerated. Should the

termination be by gangrene, the skin becomes livid or black, its whole texture more or less disorganized, while the bullæ or phlyctenæ which often form in these cases are filled with a bloody serum. The cutis, when examined after death, whatever may have been the form of the disease, is always found greatly thickened and infiltrated, but the redness, except in cases of gangrene, has entirely disappeared.

It is seldom that erysipelas is limited to a simple affection of the skin; for, more commonly at some period of the disease, the corresponding portion of the areolar tissue becomes the seat of a serous exudation; and it may suppurate, or proceed to gangrene. When the termination is by effusion of serum, the quantity of fluid effused is generally so considerable that the head, face, or limb, is greatly and sometimes even hideously swollen; and if the part be now incised, the vessels are seen enlarged and more numerous than usual, and the cellular tissue loaded with serum, sometimes turbid and flaky. The tissue is also more easily torn than usual. This inflammation may terminate by absorption of the serum, but in a few cases ulceration follows, and in some gangrene. Adhesive inflammation seldom takes place in erysipelas without its being accompanied by a serous effusion, and the occurrence of suppuration. Suppurative inflammation is, indeed, uniformly preceded by serous effusion, and the result may be the formation of an abscess; or what is much more common, pus may be *infiltrated* through the areolar tissue uncircumscribed by an adhesive inflammation—a circumstance improperly considered by many pathologists as pathognomonic of erysipelas. The parts more usually the seat of phlegmonous circumscribed abscess are the eyelids, and the integuments covering the cheek-bones, and the pus in these cases is usually of a laudable and healthy character. In all other parts of the body the abscess is generally diffuse; and, the inflammation being of a low type, the pus is poor, and often little more than a fetid sanies. Should the parts slough, the purulent fluid becomes loaded with a dirty broken-down areolar tissue, generally mixed with some loose lymph. In some instances the suppurative process extends between the muscles, causing extensive and often irreparable mischief. In the event of this inflammation terminating by gangrene, the integuments of an entire limb are sometimes detached, laying bare the muscles, a large artery, or a

bone, involving the aponeuroses and tendons, and sometimes destroying the interior of a joint. Gangrene, however, does not equally take place in all parts, for it is seldom seen on the scalp, the face, or the trunk. It is the extremities, then, and more especially the leg and thigh, and also the labia and scrotum, that more particularly suffer from this affection.

The appearances found within the cranium are similar to those found in typhus fever. In a few instances the mucous membrane of the intestinal canal has been found inflamed or ulcerated, but not so frequently as to be regarded as an essential part of the disease.

Symptoms.—The symptoms of erysipelas arise out of the fever and local affection, and appear of various degrees of intensity.

In acute cases of erysipelas the erysipelatous inflammation is generally preceded and accompanied by fever; and the attack may be sudden, or ushered in by rigors, irregular flushings, muscular pains, accelerated pulse, white tongue, nausea, vomiting, and deranged bowels. Sore throat is an early and constant accompaniment. These symptoms, when they do exist, last for some hours, perhaps till the end of the second night or beginning of the third day, when the fever becomes continued, and shortly afterwards the cutaneous inflammation appears, but without any remission of the fever. The inflammation generally appears at the seat of any injury to the skin, such as a wound, and is most intense there. By some, indeed (Trousseau, for example), it is held that erysipelas always originates from some external injury or irritation, which may be very slight.

But this character erysipelas has only in common with other eruptive diseases, as Mr. Paget has described in his admirable address in Surgery, delivered to the British Medical Association at their meeting in London, in August, 1862. He noticed that, "having cut a boy for stone, the boy became very ill three days afterwards, and seemed in danger of his life; but soon a vivid red eruption appeared at and about the wound. This was measles, earliest and most intense at the seat of injury, just as erysipelas might have been. Thence it extended and ran its ordinary course, and did no harm." Mr. Paget also states that he has seen similar events with scarlet fever, the eruption commencing in an injured and inflamed knee. Dr. William Budd records similar events in a case of small-pox, in which the eruption first appeared and was

most intense over a bruise on the nates. The argument from such facts is, "that the local determination of erysipelas and of other allied diseases, after operations, is no proof of their local origin or local nature."

Diagnosis.—The diagnosis of erysipelas is in general easy. For a few hours, perhaps, if a joint be attacked, it may be mistaken for acute rheumatism; or if a surface be attacked it may be confounded for a short time with erythema, but the intumescence and spread of the disease quickly enable us to rectify the error.

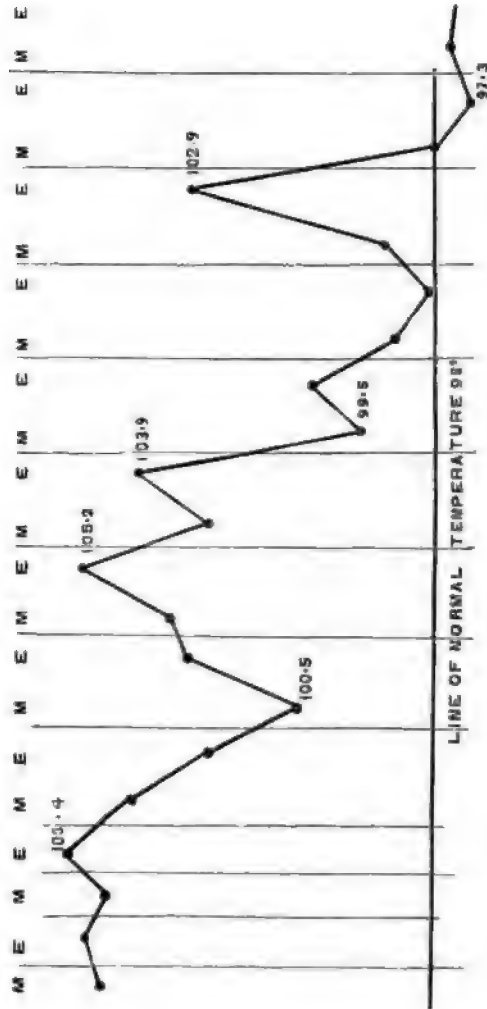
Frank has pointed out a symptom which he considers diagnostic—namely, that whenever a patient has exhibited, for twenty-four or forty-eight hours, an intense febrile movement, attended with *pain, swelling, and tenderness of the lymphatic glands of the neck*, he does not hesitate to announce the approaching development of erysipelas; and in no case has the diagnosis been invalidated by the result.

The advent of the disease is marked by a white tongue, by headache, oftentimes by delirium, and by a pulse varying from 90 to 110; and if the disease be mild these phenomena may constitute the "beginning and the end," the tongue not passing into the brown state. More commonly, however, the fever proceeds, and about the fourth, fifth, or sixth day the tongue becomes brown and dry, the temperature falls perhaps to the natural standard, but the pulse rises to 120 or 140; and the active delirium changing to a low muttering with subsultus, marks the formidable second stage of this dangerous disease. This defervescence is often extremely rapid, sometimes not lasting more than a few hours, or at most three or four days, when, if the termination be favourable, the tongue continues to clean, the pulse becomes slower, the delirium subsides, and the patient gradually recovers.

The course of the fever in erysipelas is very similar to that of measles; but the advance of the fever to its height continues longer, and the epoch for the commencement of the defervescence vacillates between the *fourth* and the *eighth* days. The defervescence, as a rule, is rapid; the normal heat being attained, or nearly so, in from twelve to thirty-six hours. Frequently, however, the case is not terminated therewith. New relapses may take place, and the course of the disease may be prolonged through two or even three weeks. These relapses are severally of short duration; but they come on again and again, and are ushered in

by a smaller or larger increase of heat, and they are connected with a renewed spread of the cutaneous affection; and it is only after the eruption has ceased that complete and definite defer-
vescence ensues.

THE FOLLOWING DIAGRAM REPRESENTS THE TYPICAL RANGES OF TEMPERATURE IN A CASE OF ERYSIPELAS WITH RELAPSES AFFECTING THE FACE. THE RECORDS INDICATE MORNING (M.) AND EVENING (E.) OBSERVATIONS :—



The *local* symptoms vary according to the part affected, the mode of termination of the inflammation, and also according to the character and duration of the fever.

are greatly aggravated by the compression of the inflamed parts, and much organic mischief may result from the confinement of pus and the various products of the gangrenous state.

Erysipelas Gangrenosum.—As the name implies, this form is accompanied with death of parts, and the tendency to death of tissue may be due either to the inherent depressing nature or malignancy of the cause, the depraved state of the system, as of the blood, the co-operating influences of an epidemic constitution, debility, confined and impure air, as in crowded hospitals, unwholesome or scanty food, or simply the excessive violence of the inflammation. The peculiar hot and burning pain, with the purple or livid hue of the redness, indicate the tendency to gangrene; and its near approach is shown by the slowness with which the blood returns after removal by pressure, and by the formation of vesicles (phlyctenæ) filled with turbid reddish serum. These vesicles are to be distinguished from those which are to be seen on the skin in severe contusions on fractured limbs. The fluid in the vesicles of gangrene can be pressed from under one part of the cuticle to another, which is not the case in the vesicles on a fractured limb or a severe bruise. Patients with typhoid fever, infants soon after birth, and young children are most frequently the subjects of gangrenous erysipelas; and it is not uncommon in hospitals, during the prevalence especially of malignant epidemics of erysipelas.

Cause.—The mystery which hangs over the origin of disease poisons does so, in a remarkable degree, over erysipelas; for this disease is often epidemic, and appears to be very constantly present.

The predisposing conditions are age, mechanical or chemical injuries, as blows, punctured wounds, and incised wounds generally, bites of insects, or burns; also certain articles of diet, as mussels or periwinkles; and, many diseases likewise, as dropsy, typhus fever, and others of a debilitating kind. The effects of age in predisposing to this disease are considerable. New-born children, for instance, are occasionally subject to it, but from that period to adult age it is seldom witnessed. The period of life most subject to acute attacks is from twenty to forty; and to chronic attacks from forty to old age. Both sexes suffer in nearly equal proportions.

Propagation of the Disease.—The spread of erysipelas has been

so frequently observed, both in the sick room and in the wards of hospitals, that no doubt can exist of this disease being communicable by impalpable emanations. In the year 1760 erysipelas spread so extensively through the wards of St. Thomas's Hospital, in London, that it was believed the plague was in the hospital. Dr. Baillie described it as spreading also in St. George's Hospital, London; and Dr. Cullen in the hospital at Edinburgh. It has been found to spread extensively on board ship; and Drs. Wells, Watson, and others, have given several remarkable instances of its spreading in families.

That it is communicable by some palpable virus, was shown by Dr. Willan, who says, that if a person be inoculated with the fluid contained in the phlyctenæ or vesicles of a genuine erysipelas, a red, painful, diffused swelling and inflammation analogous to erysipelas is produced. The danger, however, attending this experiment has not allowed it to be repeated.

Erysipelas also spreads by *fomites*. In hospitals, wards are occasionally obliged to be cleared out, to stop the continued spread of erysipelas. In the navy the spread by fomites is so well understood that it is debated whether swabbing the decks or dry rubbing them is the best mode of disinfecting a ship, and preventing the spread of the disease. It has spread extensively, and for long periods, in the Birmingham, Edinburgh, Glasgow, and London hospitals, and is only got rid of by emptying and whitewashing the wards. It is said, however, that dry rubbing is preferable to washing, moisture appearing to promote the extension of the disease. The old "Dreadnought" hospital ship in the Thames was so impregnated with the *fomites* of erysipelas that she had ultimately to be broken up, and a new vessel substituted.

A patient having passed through an attack of erysipelas, has no security against future attacks of the disease; and many persons suffer repeatedly from erysipelas, some periodically. There appears to be a constitutional predisposition to the disease in some people, and especially in those who have periodic attacks. Some women have attacks every month. Intemperance, and all influences which tend to depress the system, predispose to the disease, and hence partly the prevalence of the disease in hospitals. But there are unquestionably some unknown conditions of the atmosphere which seem to favour the dissemination of the

disease. It has been observed that this predisposition to erysipelas exists in the ordinary wards of hospitals at the same time that puerperal fever prevails; and it was formerly not an unfrequent accompaniment of small-pox.

Period of Latency.—This disease has occasionally followed a few hours after exposure to the infection. Dr. Elliottson thinks five days elapsed in his own case, and Dr. Watson has given three cases in which the interval was a week. It has been observed in hospitals that a fortnight has elapsed after its subsiding in one case and appearing in another in the same ward. It is probable, therefore, that the period varies from two to fourteen days.

Erysipelas and puerperal fever are interchangeable diseases, the one being able to induce the other by personal contact. Destructive epidemics of erysipelas have now and then occurred in Europe, and several parts of America have of late years been the scene of similar ravages, especially in the New England States, the South-Western States, and the interior of Pennsylvania (DR. WOOD).

Prognosis.—This disease is so influenced by treatment that it is difficult to estimate the proportion of deaths or recoveries. Some practitioners give as a result one death in three; while others affirm it to be only as one in ten, or even a much larger number. The influence of any existing epidemic constitution must also be taken into account. In erysipelas of the face the chief danger arises from the membranes of the brain becoming involved.

Treatment.—Broussais states that when he served with the French armies in Italy, he has seen erysipelas allowed to run its natural course, and the result was, that it made immensely rapid progress, and ended either in suppuration, in gangrene, or in fatal visceral inflammation.

Erysipelas, in the opinion of some, is a disease of simple inflammation, and consequently ought to be treated by general and local bleeding; while, on the contrary, others contend that it is a specific inflammation; and long experience has shown that bleeding is often injurious, while a tonic mode of treatment is much more uniformly successful.

There are very few physicians, from the days of Hippocrates to the present time, who have not bled patients in erysipelas, and consequently this experiment has been made on a large scale;

still many of the warmest advocates of bleeding admit that the operation is occasionally followed by unpleasant consequences. Indeed, the treatment by bleeding has been often followed by so many unfavourable results, that many physicians, the most intelligent of the profession, affirm that, according to their experience, the practice is not only unfavourable but highly injurious. Andral is reported to have said, "In erysipelas with delirium, bleeding pales the skin, but the disease continues; the cellular tissue remains gorged, and death follows. We open the body but find nothing." Cruveilhier says, "*des erysipèles rentrés*," is a consequence of unusual or too abundant bleeding, and he considers the question of bleeding in this disease to have been "*depuis longtemps jugée*." Blache and Chomel likewise say that "Experience has proved that general bleeding has no other effect than to blanch the eruption without notably abridging its duration." In this country, Drs. Fordyce, Wells, Pearson, Heberden, and Willan all give their testimony to the frequent ill effects of bleeding in this disease; and, in consequence, they, for the most part, recommend a tonic treatment.

It is therefore to be recollected that bleeding will not cure the *erysipelatous* inflammation, in the way that it produces a salutary effect on an idiopathic inflammation of the lungs, occurring in an otherwise healthy person. It is also to be borne in mind that, as a rule, bleeding is not borne well by persons suffering from erysipelas; and also, it is necessary to be ever mindful of the fact that people of a certain class in populous towns cannot bear bleeding so well as those who pass their life in the country. For instance, a brewer's drayman in London, accustomed to rejoice in the beverage which he delivers to his customers, would sink suddenly under the influence of a bleeding; when, if double or even treble the amount of blood were abstracted from a countryman suffering from erysipelas, but heretofore in good health, it would produce but little effect, and that probably for good. Bleeding, as a rule, is only indicated when there is danger of suppuration or gangrene in consequence of the violence of the local disease, or if some internal or vital organ appears threatened with an inflammatory process; and even then the circumstances of the case demand the most careful study and attention, especially in all those particulars which are indicated in the account given of the pathology and causes of this disease.

Rest, saline laxatives, cooling drinks, and low diet are the elements of treatment in mild and simple cases. An emetic is useful at the commencement; and I have seen, in the practice of an eminent surgeon, that frequent resolution of an erysipelatous attack has followed an antacid laxative, such as of rhubarb powders and carbonate of soda, together with the counter irritation of a mustard poultice over the stomach. Laxative and cathartic remedies are to be selected and apportioned according to the violence of the attack and its nature, as tending to the unfavourable results of the specific inflammation already noticed. Calomel is a most valuable purgative, as a sedative in febrile disturbance, especially when followed by castor oil, or the common black draught. The indications to the use of certain remedies, as given in the treatment of scarlet fever, are equally applicable here.

If the febrile state is not subdued, antimonials are of great service, for so far as they are diaphoretic in their action they tend to subdue the vascular excitement. If symptoms of nervous depression ensue, opium, or opium and ipecacuanha are indicated, also wine and quinine, especially in a tendency to a typhoid state. The tincture of the muriate of iron, in doses of twenty drops, *three, four, or five* times a-day, is now also a remedy much in use.

Local applications are potent for good or evil, and must therefore be used with great caution. The effects seen on the skin do not constitute the whole disease; and if the development of these processes on the cutaneous tissue is imprudently interfered with, there is imminent danger to internal organs. To check the advance and prevent the encroachment upon new territory, rather than to subdue it if already in possession, ought to be the sole aim of local treatment; and to mitigate the local pain and uneasiness. Bland mucilage, such as that of viscid lintseed tea, from which light muslin cloths have been steeped and spread over the inflamed surface, sometimes affords relief. Dry flour, or rye-meal, dusted from a dredge box frequently over the erysipelatous patches, are also soothing applications.

To arrest the spread of the process over sound skin, nitrate of silver in very strong solution, or tincture of iodine, are efficient agents. A line of circumvallation is to be painted round the erysipelatous part, so as completely to enclose it. The nitrate of

silver should either be employed in the solid stick, or as proposed by Higginbottom, in solution of eight scruples of the nitrate with twelve drops of nitric acid in a fluid ounce of water. Dr. Wood has practised with success, and recommends the use of tincture of iodine.

Long and deep incisions into the inflamed textures are sometimes demanded. This is more especially the case if there is tension of fibrous tissue, such as the subcutaneous fasciæ; and erysipelas of the head is frequently greatly alleviated by repeated innumerable minute punctures, made by the point of a lancet all over the parts of the face and scalp which are affected.

THE PLAGUE—*Pestis*.

Definition.—*A malignant fever which has prevailed at different times and places epidemically; attended with an eruption of a complex nature composed of buboes or swellings of the lymphatic glands, carbuncles, pustules, spots, and petechiæ of various colours, and distributed in different parts of the body.*

Pathology and History.—Modern medicine restricts the term “plague” to a disease of dreadful severity, and of a peculiar character, which appears to have been first recognized in Egypt and in the neighbouring countries.

It is impossible to determine the time when the plague first appeared in Egypt. The remotest period to which we can distinctly trace it is when spreading into other countries, as the plague of Constantinople, which broke out in 544, when Justinian was emperor. This is the first time that the disease, from its course and symptoms, can with certainty be recognized as the plague of modern times. It was so severe that at one period ten thousand persons are said to have died daily in that city. The symptoms were shivering and fever, at first so slight as to alarm neither the physician nor the patient, but the same day, the next day, or the day after, there appeared swellings of the parotid, axillary, or inguinal glands, with carbuncles, and sometimes gangrene; and from the more usually diseased state of the glands it was called “*pestis inguinaria*.”

The disease from that period has prevailed at short intervals in various parts of Europe as late as the seventeenth century. Sir Gilbert Blane has calculated there were no less than forty-five

epidemics of plague in the seventeenth century. Fourteen of these occurred in Holland, imported, it is supposed by the Dutch engaged in the Levant trade, about the year 1612; and twelve in England, imported, as has been supposed, from Holland. The last epidemic of plague which prevailed in both of these countries was in 1665, the year before the memorable fire of London. This epidemic was termed the "Great Plague," and spread "with such intolerable infection" that 7,165 persons are said to have died in one week, while in one year no less than 68,526 died in the city of London and its suburbs alone; an immense mortality, considering the then comparatively small amount of population.

The plague is still occasionally epidemic in Egypt, and sometimes prevails on the Barbary, Arabian, and Syrian coasts, and also at Constantinople; but it has been rarely seen out of the Turkish dominions since the seventeenth century. Nevertheless, it broke out at Copenhagen in 1712, at Marseilles in 1720, and at Moscow in 1771. In the present century it has appeared at some of the Russian ports in the Black Sea. In 1813 it broke out at Malta and at Gozo, when the number of victims were estimated at between 4,000 and 5,000. It subsequently broke out at Noja, in Calabria, in 1816; at Corfu in 1818; it appeared at Gussemberg, in Silesia, in 1819; and lastly, in 1828-29 it devastated the ranks of the Russian army in Bulgaria; and there is reason to believe that at Odessa, towards the end of the recent Russian war, there were cases of a malignant fever, with buboes and swellings in the glands of the groin and axilla, which policy prevented calling plague.

It is believed that in this disease, as in others of this order, a specific poison, after a given period of latency, produces certain specific actions, which are either preceded, accompanied, or followed by fever. The more specific actions of the poison are the induction of a state very similar to that of typhus fever, as seen in this country; also a singular enlargement of the heart, the liver, or the spleen. But the most constant action of the poison is on the lymphatic system generally, as in typhus fever—the cervical, inguinal, axillary, and mesenteric glands being for the most part found enlarged or otherwise inflamed, and thus giving rise to the characteristic bubo. The areolar tissue also appears to be often the seat of a specific action of the poison, it being

frequently affected with carbuncles; every organ and tissue of the body is likewise covered with petechiæ, and often the seat of hæmorrhagic effusion.

The extreme danger believed to attend posthumous examinations, and the prejudices of the Mahommedans, long prevented our acquiring any satisfactory data respecting the pathological phenomena of the plague; but a commission appointed by Mohammed Ali in 1834-35, and consisting of Clot Bey, Gaetani Bey, Lachesi, and subsequently of Bulard, examined the bodies of sixty-eight persons who died of the plague, and the following is a summary of their results.

On removing the cranium the sinuses were found filled with black blood, the arachnoid veins greatly injected, and the arachnoid cavity often infiltrated with serum, and occasionally with a trifling effusion of black blood. The substance of the brain was generally less consistent than in health, and sprinkled with more bloody spots than usual. The bronchial membrane appeared sensibly inflamed, although during life the patient had presented no catarrhal symptoms. The pericardium frequently contained a reddish serosity. The serous membrane covering the heart and pericardium was often extensively affected with petechiæ. The heart, distended with blood, was almost always enlarged from a third to a half greater than its natural size; its tissues being often pale, and sometimes softened.

In acute cases the stomach was generally normal, but more commonly there was a partial redness of the mucous membrane, like confluent petechiæ. In more chronic cases it was of a deep red or slate colour. Its mucous tissue was often softened, the seat of superficial ulceration, especially between the folds, and in one case blood was effused. The small intestines, except being sometimes the seat of livid petechiæ, were rarely found diseased. The ilio-cæcal valve was the only portion of the large intestines found at any time in a morbid state. Its colour was commonly livid, and sometimes it was ulcerated, the ulcers penetrating occasionally the appendix vermiformis.

The liver was almost always larger than natural, and loaded with blood, while petechial spots were often seen at its surface. The gall bladder was the seat of petechiæ, and in two cases blood was effused into the sub-mucous areolar tissue.

The spleen was always twice its natural size, or even more, but

was rarely the seat of hæmorrhagic effusion. It was also softened, and deep in colour.

The kidneys were often found immersed in an hæmorrhagic effusion into the surrounding cellular tissue. They were loaded with blood and the pelvis filled with clots. The ureters occasionally contained blood, and sometimes the lumbar glands were so enlarged as to press upon them, and to account for the suppression of urine. The bladder occasionally presented petechiæ, and occasionally the urine was mixed with blood.

Every dissection showed that buboes, wherever seated, always resulted from diseased lymphatic ganglia. These ganglia were always enlarged, and varied in size from an almond to a goose's egg. The least altered were hard and injected. In a more advanced stage some of these glands were without any change of colour, and others, again, as richly coloured as lees of wine, and either wholly or partially softened or putrescent. Sometimes these glands became agglomerated, forming masses which weighed two pounds or more, and around these agglomerations a hæmorrhagic effusion extended into the areolar tissue. The cervical glands often became so enlarged as to form a sort of chaplet united with those of the axilla and of the mediastinum. The axillary glands again communicated with the cervical, and with those which surrounded the bronchi. Those in the groin connected themselves in the same manner with those of the abdomen, and these might be traced without interruption through the crural arch into the pelvis and along the vertebral column. It was especially among these latter that sanguineous effusion was found in the sub-peritoneal tissue. The mesenteric glands were often so numerous that the whole of the mesentery seemed covered with them, but they seldom exceeded an almond in size.

The blood is evidently diseased in the plague-patient, although no analysis has shown in what this alteration consists. It is stated never to be buffed; that the serum readily dissolves the colouring matter; and that the lower part of the clot is but feebly coagulated.

Symptoms.—The poison of the plague produces those disordered functions of the great nervous centres which constitute the phenomena of fever, either of a low or of an active character, and sometimes so severe as to destroy the patient in a few hours, and before any secondary actions are set up. "At Aleppo," Dr.

Russel says, "in the most destructive forms of the plague the vital principle seems to be suddenly, as it were, extinguished, or enfeebled to a degree capable, only for a short time, of resisting the violence of the disease; and the form of the plague, beyond all others most destructive, exists without its characteristic eruptions, or other external marks considered pestilential. These cases perished sometimes within twenty-four hours."

In milder cases, the fever, of greater or less intensity, is preceded, accompanied, or followed by the secondary actions that have been mentioned. The order of the occurrence of these secondary actions, and the frequency of their accession, is not determined; but buboes, carbuncles, and petechiæ are considered as the characteristic and most frequent symptoms of the plague. Desgenettes thought the symptoms presented three degrees of intensity; so also does Aubert; and this division is adopted by the *Commission* referred to at page 359,—the first degree being a slight fever without delirium or buboes; the second degree being fever with delirium and buboes; the third degree high fever, high delirium, buboes, carbuncles, and petechiæ.

The manner in which the disease commences is very various. Many instances are given of patients being most suddenly seized; as when conversing, eating, walking, going to bed, or during sleep. More commonly the disease is preceded for a greater or less length of time by "lassitude, loss of strength, general uneasiness, and mental anxiety, to which shivering, headache, vertigo, and vomiting soon succeed; then appear the general and local phenomena, and among them bubo, carbuncles, and petechiæ, preceded or followed by delirium or coma, too often terminating in death."

The *first degree* of the disease is when the symptoms have presented only a slight fever, frontal headache, an altered countenance, nausea, and perhaps vomiting; or should this fever be accompanied by buboes and carbuncles either simultaneously or consecutively, the buboes always terminate by resolution, suppuration, or induration, while the carbuncles, more or less numerous, are always superficial. In this variety the patient rarely keeps his bed, perspiration is readily excited, and the termination is never fatal. This form is common at the height of the epidemic, and is still more so at the decline of the disease.

In the *second degree* of the plague the patient staggers as in

drunkenness, has a stupid air, an injected eye, an embarrassed speech; this is accompanied by nausea or vomiting of bilious matters, and often by diarrhoea, while in the last stage the matters vomited are black. The pulse is frequent and compressible, and the delirium tranquil or agitated. The tongue, at first moist, is often white at the centre, and red at the edges and tip; but on the second or third day it becomes dry, black, and chapped at the centre, while the teeth are covered with sordes. The secretion from the kidneys is affected, the urine being always high coloured, at times sanguinolent, small in quantity, and, towards the termination, often suppressed. From the second to the third day buboes appear in the axilla, groin, or neck, and more rarely in the ham, and about the same time carbuncles and petechiæ; and on the fourth or fifth day, in unfavourable cases, the patient dies comatose. The patient, however, may recover, and the convalescence may be either rapid or prolonged. In the former case, about the fourth or fifth day, the tongue again becomes moist, the skin open, the pulse softer, and the buboes either terminate by resolution, suppuration, or induration; the carbuncles, when they exist, limit their ravages, the petechiæ disappear, and about the sixth or eighth day the patient is convalescent. In cases more severe the black tongue and all the other symptoms continue, the buboes are slow to suppurate, their pus is serous and fetid, and convalescence is not established till the fourteenth to the twentieth day, and during this protracted struggle the patient often sinks. This is the form of plague which predominates at the height of the epidemic, and gradually disappears as it declines.

In the *third degree* every symptom is increased; the habitude and dullness is accompanied by an almost entire annihilation of the intellect, and by a prostration of strength so extreme that an upright posture is impossible. The pulse is small and frequent, the tongue moist, thick, and purple, the petechiæ of a dark colour, and the patient often dies in twenty-four or forty-eight hours, comatose, livid, and without agony. If, however, the disease should be still further prolonged, the pulse rises, the tongue is red and dry, the skin hot, the eye injected, and the countenance animated; and towards the third day an eruption of buboes, and occasionally of carbuncles, follows. The patient has now a chance of recovering, but such a result is rare. It is in this variety that

buboes and carbuncles are sometimes altogether wanting; and this is that terrible form which prevails almost exclusively in the first month of the epidemy, and is occasionally met with till its termination.

The bubo seldom matures till the fever is on the decline, which rarely happens till the eighth or ninth day; nor are they generally ripe for opening till between the fifteenth and twenty-seventh day. In general, suppuration has not been so frequent as resolution, and never were the buboes seen to be gangrenous. Aubert considers the bubo as of good augury for the patient, and its suppuration as the sign of his recovery.

The carbuncle is by no means of constant occurrence, Dr. Russel having found it only in 490 cases out of 2,700. It appears more commonly in the middle or towards the decline of the disease. Hardly any external part is free from them, not even the penis; and in one instance a carbuncle formed in the throat, which was fatal. They occur more particularly on the limbs, and more especially on the legs. In some cases they form on the cheek or lips, and by the tumefaction they cause give to the face a hideous aspect; in others the whole of one side of the jaw has been laid bare, while in others they have formed on the eyebrow and on the eyelid, and partly destroyed the eye. Clot Bey, however, observed they never formed on the scalp, the palms of the hands, or on the soles of the feet.

There are three different varieties of carbuncle, and all commence in the same way, or by a small red pimple, which increases, and in the centre of which a vesicle forms, containing first a yellow and afterwards a blackish serum. In the most benign the vesicle bursts and dries up in three or four days from its first formation, the epidermis alone having been infected. The second variety involves the whole thickness of the skin, as well as portions of the cellular tissue, which is moderately tumefied, and surrounded by a dark red areola. The gangrene in this form is circumscribed, and there results an eschar from one to two inches in diameter, which is detached by suppuration, leaving an ulcer with a sharp perpendicular edge. In the severe forms the redness and tumefaction cover a large space, and the gangrene rapidly involves the skin, the cellular tissue, and sometimes even the bones. It has been observed that the malignity of the carbuncle is in the direct ratio of the severity of the disease, but

their mere existence is not of unfavourable augury. Their number is very various, sometimes only one, at others ten or twelve. When there are several they often form in succession. These tumors are often very painful, and Aubert mentions one seated on the back of an Arab soldier four inches in diameter.

Petechiæ are observed in some seasons and not in others. They present different shades of colour according to the intensity of the disease—rose colour, violet colour, or black. Aubert considered their appearance an almost certain sign of death. The duration of the disease is from a few hours to fifteen, twenty, thirty, or even more days.

Diagnosis.—Clot Bey says the diseases which most resemble the plague are typhus fever, severe forms of paludal fever, apoplexy, dysentery, parotitis, and scrofulous or syphilitic affections associated with febrile symptoms of a typhoid type.

Cause.—The plague, and the specific poison which it generates, seem to have a very limited geographical range. Clot Bey indeed considers it to be endemic along the whole of the eastern and southern coasts of the Mediterranean; the principal centres of propagation being Egypt, Syria, and Constantinople. But most authors are agreed that Egypt is the great focus of the plague, whence it is imported into other countries. It seems determined also that the disease is often circumscribed within a very small space of country. Volney states that in Egypt the plague never commences in the interior, but always appears first on the coast at Alexandria, passes from Alexandria to Rosetta, and from Rosetta to Cairo. He considers that the poison is generated in the Delta of the Nile.

Of all the causes mentioned by authors as tending to propagate the plague, the crowded state of the population in Egypt, their misery and insufficient nourishment, are the most prominent. Every writer speaks of their mud-built huts, of their narrow and tortuous streets, and of their habitations, whether isolated, in villages, or in towns, being surrounded in every direction with heaps of dung. In these the Arab lives with his wives, his children, and his servants, and his domestic animals, all huddled together. "Unheard-of filth," says Clot Bey, "reigns in their infected haunts." Again, some authors have considered the pestilential miasma as a product of vegetable decomposition, favoured by the inundation of the Nile, and the heated blast of

the hot Khamsin; others, that it is owing to the mud deposited by the Nile; and lastly, that it is owing to the practice of making mummies of the dead, or of imperfectly or superficially burying them. Clot Bey has examined all these causes, and comes to the conclusion that, taking them conjointly or separately, they are inadequate to account for the origin of the plague. All, therefore, that we can safely affirm of this poison is, that it is at all times endemic in Egypt, and every five or six years it becomes epidemic. It also appears to be, to a certain extent, influenced by season, the plague not spreading in any very sensible degree till December, and attaining its greatest height in June, when it rapidly declines, and is popularly supposed to cease on St. John's day.

The period of the year, however, at which the plague prevails differs in some degree in different countries; but the total duration of the disease in any country, to which it is not native, appears to be inconsiderable, unless kept up by a fresh importation. At Aleppo it lasted from 1760 to 1762, a period of three years. But in Malta, Marseilles, and in the western parts of Europe, it has generally subsided in about twelve months.

We are little acquainted with the habits of this poison as it affects animals. Dogs are said to have died of buboes, either during or just preceding the plague season.

In every epidemic there is only a certain number of persons greatly susceptible of the action of the poison. The proportion of persons liable to be attacked by the plague is very great, for in Alexandria, in 1834, it is calculated that out of 42,000 souls, 14,888 perished; and in selecting its victims, this poison follows the law of most other morbid poisons, attacking the poor rather than the rich,—women rather than men,—patients labouring under disease rather than healthy individuals,—persons constitutionally feeble rather than the robust, and those addicted to intemperance, or other excesses, than those who more strictly observe the precepts of Mohammed. As to races—the Arab suffers more than the Negro, the Negro than the Turk, and, in Egypt, the Turk more than the European.

Modes of Propagation.—The belief that the plague is capable of being communicated is so general that it still continues to be the terror of Europe, and the ports of every nation are closed against a vessel supposed to have the plague on board. The facts by

which this precaution is warranted are extremely striking; for every time the plague has appeared in Christian Europe, the arrival of a ship has been an invariable antecedent, on board of which one or more persons have died of the plague. The disease, also, invariably broke out at the port or town at which such vessel arrived; and if the proper precautions were not taken, it spread into the interior of the country. The following modern examples of the plague, appearing in the West of Europe, will exemplify this statement:—

On the 25th of May, 1720, Marseilles being healthy, a vessel arrived in that port from Seyda, in Syria, having lost seven men by the plague during the voyage. It was usual to send vessels and their crews, arriving under these circumstances, or having foul bills of health, to perform quarantine at Jaru, an uninhabited island near Marseilles; but this precaution was omitted in the present case, and so negligent were the officers on duty, that the captain and passengers were permitted to land, and even to lodge in the city, while the crew were sent to the infirmary and allowed to associate with the persons attached to that establishment. It appears also that many contraband articles were thrown over the walls. In the midst of this free communication one of the seamen died of the plague, then the *garde de vaisseau*, then the cabin-boy and two porters, and lastly, on the 20th June, the plague broke out in the city itself, and raged with such fury that out of a population of 90,000 souls, it was estimated that 39,134 died. It spread in Provence, and caused considerable mortality in that department; but, nevertheless, it was limited to a comparatively small district of country immediately around the original focus of infection.

In the year 1743, Messina being healthy, a ship arrived on the 20th of March from the Levant, and three men having died during the voyage, the ship was put under quarantine in the harbour. Two days after this the captain died of the plague, and shortly afterwards another of the crew. In consequence of these events, the ship, ten days after her coming to anchor, was taken to a distance, and burnt with all her cargo. Forty days afterwards the plague broke out at Messina, when 38,000 persons are said to have died during the epidemic.

In the year 1813, Malta being healthy, a vessel called the "San Nicolo" arrived on the 29th March from Alexandria. On

entering the port she hoisted the yellow flag with a black spot in the centre, the signal of the plague on board; and the master reported the fact that two men had died on the voyage, and, as he believed, of the plague. The same day also there arrived two other vessels, likewise from Alexandria—the brig “Nelly,” and the Spanish polacca “El Dolce,” which had likewise lost some men on the voyage.

The arrival of three vessels on the same day suspected of having the plague on board, alarmed the city, and the “Nelly” and the “El Dolce” were sent away the next day, while the “San Nicolo,” belonging to a merchant resident in the island, was put under quarantine. On the third day the captain was seized with symptoms of the plague, and died in thirty-six hours. His servant was seized about the same time, and he also died. On the 16th of April following, the first death from plague occurred in the city of Valetta; and on the 3rd of July, the disease had spread so extensively that the organization of a police was begun, for the purpose of isolating the city and “shutting up” its inhabitants. It is remarkable that, although the plague spread to many towns or villages in the island, no sooner was the affected town or village surrounded by a cordon of troops, and thus isolated, than the disease was limited to that spot, and never spread in any instance to the troops immediately without it.

It is manifest that the antecedent arrival of a vessel having the plague on board at each of the three ports of Marseilles, Messina, and Malta, and the breaking out of the disease in all those places shortly afterwards, is so remarkable that it can be only explained by admitting the connection of cause and effect. Moreover, the fact of the plague having originated in the preceding instances from imported cases of the disease, and not from any local influence, is demonstrated by the exemption of large bodies of persons “shut up” in the very heart of the pestilence. Thus, in the plague at Marseilles, the large nunnery of Les Dames de la Visitation Sainte Marie “shut up,” and, although there was an infirmary on one side for those ill of the disease, and a burying-ground on the other for those who died of it, yet all the inmates of the nunnery escaped. The Hôpital de la Charité of the same city, a sort of poor-house, making up about 300 beds, “shut up,” and escaped with complete impunity; but being converted into an infirmary for the plague-patients, 200 of the poor, left in

attendance, all died of the malady. In the plague of Moscow, 1770-71, the Imperial Foundling Hospital, containing 1,400 souls, "shut up;" and although more than 100,000 persons are supposed to have fallen victims to this pestilence in that city, yet, excepting some eight persons who surreptitiously went into the city and were instantly separated, none caught the disease.

Another class of facts, demonstrative of the communicable nature of the plague, is the great number of persons attending on, or in communication with the sick who die from this disease. The French army, on first taking possession of Egypt, lost no less than eighty medical officers by the plague—an immense proportion compared with the loss of the army generally. In the English army only one in forty-eight of the military, generally, died of the plague, while one-half of the medical officers died. Some few persons also have ventured voluntarily to inoculate themselves with plague-matter, and these have, with hardly an exception, fallen victims to their rash experiments.

It is important to determine what length of time the pestiferous miasmata may be preserved in an active state in the substance they adhere to; and modern experience seems to prove that the period is not long. In Egypt and Syria, the day after St. John's Day, when the plague has hardly disappeared, the clothes of many thousand persons dead of the disease are openly bought and sold in the market-places, without any apprehension of infection. Another strong fact is, that the hospital Esbekié, at Cairo, in which more than 3,000 plague-patients had been treated, at the close of the epidemy, and while some of the affected were still left in it, was appropriated to a different class of patients; and, from some neglect of the servants, these persons slept in the same beds, under the same woollen counterpanes, and with no other change than the blankets, and yet no individual caught the plague. It is singular, also, that immediately after the plague of London, "the houses," says Hodges, "which were before full of the dead, were now inhabited by the living, and the shops, which had been most part of the year shut up, were again opened;" and "many went into beds where persons had died, even before they were cold and cleansed of the stench of the disease," and yet it appears there was no evident extension of the disease. Mr. Tully states, that the experience acquired in the plague of Corfu proved, that effects of all kinds can be

securely purified by subjecting them to the combined or even individual action of pure air or water, and that the tents employed in the plague-camps, after being washed half a dozen times in salt water and dried in the sun, were delivered into His Majesty's stores, and shortly after employed in the encampment of the garrison. A voyage from Egypt is evidently capable of disinfecting all *fomites*, for no quarantine officer of Great Britain has been infected with the plague since 1665. It seems, therefore, that when the plague is imported into any country, the infection or contagion must be renewed by the sickness or death of some portion of the crew during the voyage.

Dr. Russel states that at Aleppo he met with 28 cases of re-infection, or 1 in 157; and Clot Bey states that he and his colleagues saw many individuals perish of plague in 1834-35 who had formerly survived an attack of the disease.

Period of Latency.—The period of latency is a question of great moment in treating of the laws of the plague, as being that circumstance which ought to determine the length of quarantine for the person. Dr. Russel states he has known persons long shut up taken ill almost immediately, or in a day or two after coming out of confinement. Aubert also gives the case of a Maltese who was taken ill on the second day after his arrival at Alexandria. The minimum period of latency, therefore, is short. As to the maximum period, Dr. Russel says, "I met with no instance of the disease discovering itself later than the eighth or ninth day." Aubert and Clot Bey seem to have adopted the same opinion. Father Maurizio extends this period to fifteen days; Sir James M'Grigor to seventeen days; while M. Bertrand, from his observations during the plague at Marseilles, places the extreme period at thirty-five days. It is probable, however, that there must be some error in this last observation, and, consequently, that the extreme periods of latency may safely be stated to be from a few hours to twenty days.

Prognosis.—Desegnettes calculated that not more than one-third of the French soldiers attacked with plague recovered. In the plague of Marseilles 40,000 are said to have died out of a population of 90,000. At Malta, dividing the months of July, August, and September, into two equal parts, 90 in 100 cases died in the first half, and 60 in 100 cases in the second half. At Alexandria, in 1834-35, out of a population of 42,000 persons,

14,000 are supposed to have perished. Clot Bey estimates the whole mortality for Egypt in that year to be as one in three of those attacked.

Many instances are given of a patient apparently convalescent, and even walking about, dropping down and expiring; but in general, says Clot Bey, cyanosis and partial coldness of the extremities, petechiæ, and the subsidence of the buboes were the grave symptoms. Pregnant women always aborted when seized with the plague, and all those near their time invariably died, and that even when the loss of blood had been inconsiderable.

The favourable symptoms are, a quick re-action, abundant sweats, and the suppuration of the buboes.

Treatment.—In the treatment of the plague neither the practice of the French nor English medical officers serving in Egypt has led to any happy result; and it is to be regretted that recent experience has not in any degree advanced the successful treatment of the plague. "In the beginning of the epidemy," says Clot Bey, "when the morbid cause acts with a rapidity so great that some hours are sufficient to compromise the life of the patient, every treatment, even the most energetic, is powerless to arrest the course of the disease. When, however, the intensity of the disease abates, we may hope for the recovery of the patient." Looking, however, to the pathology of the disease, and regarding it as a form of malignant *typhus fever*, the principles of general treatment ought to be similar to those laid down in the account of that disease.

The treatment of the *bubo* was first attempted by actual cautery or a blister, but the *Commission* appear to have afterwards abandoned this mode of treatment, and to have applied emollient poultices as a mode of favouring suppuration and of mitigating pain. As soon as matter was formed they recommended the immediate opening of the tumor.

The treatment of the *carbuncle*, when benign, was by poultices. If, however, the slough was deep, the part was cauterized down to the living flesh. When the mortification was of great extent a circular incision was made in the integuments immediately round the tumor, and an iron, heated to a white heat, was introduced into the furrow. The subsequent dressing was lint steeped in the chloride of zinc, and when the part granulated up it was then dressed with a compress.

The diet to be observed in the management of cases of the plague is very imperfectly laid down by the different writers who have treated on the subject; but no doubt it must be the same as that observed in other febrile disorders—namely, that the strength of the patient should be supported by broths, soups, and, if necessary, also by wine.

Preventive Treatment.—The preventive treatment may be divided into the measures necessary for the protection of the attendants on the patients; into those which are necessary to prevent the introduction of the plague into any given city; and, lastly, into those which should be adopted, supposing that disease to have broken out in any town, city, or camp.

The only mode of preventing personal contamination is for the attendants on the sick to avoid as much as possible all direct contact with the patient or with any article, whether of linen or of any other kind, that he may have touched, or which has been in any way in contact with his person. The active and frequent use of disinfectants ought to be systematically employed. The atmosphere of a plague hospital was found, both at Malta and at Cephalonia, to be so little noxious that the attendants slept in the wards with impunity, provided they secured themselves from all personal contact.

As to preventing the introduction of the plague into any city to which it is not native, it must be admitted there is no other resource than in quarantine, and the length of the quarantine should be the longest period of latency, *plus* the time it takes to overhaul the cargo. The longest period determined by Sir James M'Grigor for the latency of the poison is seventeen days, while the time taken to unload the cargo may be estimated about four to six days, making the longest necessary period of quarantine to be twenty-one, or at most twenty-four days.

When the army was in Egypt a minute inspection was made of every corps and of every department twice a-week, and any person with the slightest appearance of ill-health was sent to the hospital; also every corps or hospital where a case of plague had appeared was put into a state of quarantine, and of such corps an inspection was made by the surgeons at least two or three times a-day; and every case with suspicious symptoms was ordered to the observation-tent or room, and on the plague appearing, such case was immediately sent to the pest-house.

The men were likewise ordered to bathe frequently, and their clothes and bedding to be frequently washed and baked, while the quarters of the army were frequently changed.

SECTION II.—THE CONTINUED FEVERS.

Fevers have been classified according to various theories; and much has been written on the subject. In the previous section those diseases have been described in which an eruption on the skin especially challenges attention, and with the appearance and development of which more or less fever is associated. They are described by most systematic writers as a separate class, under the name of "The Eruptive Fevers."

The "Continued Fevers," now about to be described, were at one time all recognized under the single name of "Common Continued Fever," of which it was believed there were several varieties. But since about the year 1840 specific differences have been gradually becoming more and more obvious, so that now at least FOUR DISTINCT FEVERS can be recognized, allied by certain common characters, but no less distinctly separable by peculiar and distinctive marks. The plurality of continued fevers must now therefore be generally admitted.

The four fevers about to be described have been mixed up together in almost every epidemic in various proportions, so that each epidemic of fever has held a peculiar character according to the nature of the dominant disease which was mainly prevalent.

The four forms of Continued Fever are now named respectively as follows:—(1.) Typhus Fever; (2.) Typhoid, Enteric, or Intestinal Fever; (3.) Relapsing Fever; (4.) Febricula.

Much has been spoken and written about the identity and non-identity of *typhus* and *typhoid* fevers; and in the former edition of this work I stated my belief that these two forms of continued fever were identical in their nature—*i. e.*, were varieties merely of a fever which resulted from one and the same specific poison. I entertained this belief partly because I had been taught as a student so to believe, and partly because I considered that the evidence then existing on the subject, and with which I was acquainted, did not fully justify any other conclusion. This belief I no longer entertain. Proofs of numerous

and remarkable differences of a specific kind between *typhus* and *typhoid* fever have been slowly but surely accumulating since the beginning of the present century. The dissections by Prost, of Parisian fever patients in 1804, may be said to have laid the foundations of our knowledge, and to have turned the attention of pathologists in the direction which has led to such definite results. In more than 150 dissections he always found "inflammation," with or without ulceration of the mucous membrane of the intestines. Petit, Serres, Pommer, and Bretonneau followed up the investigations of Prost; but the celebrated treatise of Louis, in 1829, was the first to give a complete and connected view of symptoms as well as of *post-mortem* lesions in the fever common in Paris; and although Prost asserted the connection of a certain intestinal lesion with a definite series of symptoms, still it was Louis alone who described the lesion in terms sufficiently precise, and indicated with scientific exactitude the symptoms with which it is concurrent. The views of Louis were subsequently adopted by Chomel and Andral in France. In other parts of Europe, however, and especially in England, bodies of numerous fever patients were opened without finding any disease of Peyer's patches, although differences in the symptoms detailed regarding the fevers of France and England were not then so obvious. Hence arose at once two opinions, based on a *post-mortem* distinction, the "anatomical sign," described by Louis. The first opinion was that this "anatomical sign" was an incidental occurrence; or, that its occurrence was in some way connected with locality, the cases of fever being everywhere considered identical. A second opinion, however, soon began to gain ground, especially when the intestinal lesion was not found by the most careful observers in some cases where it was intentionally looked for (as in the epidemic of Toulon in 1829-30). A belief now, therefore, began to gain ground that there were in fact *two diseases* which were indifferently named *typhus* and *typhoid fever*—that one prevailed only at Paris and the other in England, in Germany, and elsewhere, being also sometimes more or less mixed up with the Parisian Fever, as measles may be with scarlet fever. Louis subsequently (1841) adopted this view.

In 1835 the "Académie de Médecine" formally proposed the question, "What are the analogies and the differences between the *typhus* and *typhoid* fevers?" The question excited considerable

interest in France, but less so in England, where a strong bias has always prevailed towards a belief in the doctrine of a single fever—a belief entertained and taught by the most eminent observers and teachers of the day. But dissenters arose. Scotch, English, and American physicians, practically familiar with the fevers of their own countries, began to visit Paris to study fever there; and they were not long in learning to recognize the chief points of difference between the two fevers. Gerhard and Pennock, of Philadelphia, in a systematic treatise, were the first to indicate (1836) these differences, it having been already determined by Jackson and Gerhard that the fever described by Louis under the name of *typhoid fever* existed in America, and presented there the same assemblage and development of symptoms, and the same *post-mortem* lesions as the Parisian fever.

In 1836 M. Lombard, of Geneva, after visiting London, Edinburgh, and Dublin, ultimately came to the conclusion that two different fevers had been confounded together; and Drs. Staberoh, of Berlin, and Kennedy, of Dublin, professed the same belief through the same medium—the *Dublin Journal*. During this year (1836) also, Dr. A. P. Stewart commenced his observations in the Glasgow Fever Hospital, where he continued his inquiry for two years. His attention was first especially directed to the study of fever by Dr. Peebles, who, during a long residence in Rome, had observed the maculæ of typhus in the contagious fever of Italy, and who first showed the difference between the characteristic eruption of fever and the cutaneous affection to which the name of "*petechiæ*" is given. (*Ed. Med. and Surg. Journal*, 1835.) He pointed out this eruption to Dr. Perry (then Physician of the Glasgow Fever Hospital), "and who" Dr. Stewart states, "was the first to maintain the complete difference of the two eruptions—namely, those of *typhus* and *typhoid fever*. Dr. Stewart subsequently went to Paris and examined the fever there. The result was a complete recognition of the existence of two fevers, and of their differences—an account of which he published in the *Edinburgh Medical and Surgical Journal* for 1840, p. 289.

In 1839 Enoch Hale published an account of the fever of Massachusetts, and distinguished among them two perfectly different forms of fever, one of which agreed with the Parisian

fever, while the other might be held to represent the fever described by most English writers.

Soon after this the characters of the prevalent fevers of England were noted by Shattuch (another American pupil of Louis), who published his results in the *Boston Medical Examiner*.

The appearance of these papers, and of others about this period, gave rise to an elaborate discussion of the whole question (in the pages of the *British and Foreign Medical Review*, vol. xii, p. 293); and the conclusion the reviewer arrived at seemed to favour the opinion "that the French and English fevers were varieties, that is, different developments, of a common stock, but not specifically distinct diseases." I understand the eminent physician who wrote that review now believes in the specific distinction of the two fevers.

In America the doctrine of a specific distinction between the two fevers has been generally adopted; as represented in the treatise of Dr. Bartlett, of Philadelphia, in 1842 and 1847, on *Typhus and Typhoid Fevers*, and on *The Fevers of the United States*.

In Germany three opinions were entertained. The typhoid fever of Louis received from them the name of "abdominal typhus"—thus regarding the disease as a variety of typhus fever. By some, however, it was regarded as a disease distinct from the "*typhus exanthematicus*." A third opinion also found followers—namely, that this *abdominal* typhus was the only form of continued fever—the result of a limited and narrow field of investigation.

Up till 1846 opinions were thus divided, crude, and in not a few instances quite unformed. Relapsing Fever was distinguished by some, but not by all; and all other forms of continued fever were considered in this country as identical. Under those circumstances the inquiry was taken up in 1846 by Dr. Jenner, then Professor of Pathological Anatomy in University College, and worked out by him systematically in the London Fever Hospital. There he patiently accumulated case after case of fever, until he had nearly 2,000 accurate reports before him. From these he separated all cases of relapsing fever, and then instituted a rigorous comparison of the remaining cases. He selected the fatal cases which had been examined after death, and

the diagnosis of which had been confirmed. He found that he had 66 such cases and *post-mortem* examinations. Of these 66 cases, 23 had the intestinal and mesenteric lesion—the “anatomical sign” (according to Louis) of typhoid fever; and 43 cases were without this appearance. The question then remained for solution; namely—Did these 43 cases (in which the intestinal lesion was not present) differ so much in symptoms and *post-mortem* appearances from the other cases (in which the “anatomical sign” referred to was present) as to render it impossible to suppose that they were cases of the same disease? Or,—contrary to the opinion of Louis,—Were the symptoms of the two sets of cases so similar as to lead to the belief that the presence or absence of the intestinal lesion (the “anatomical sign”) was a matter of little consequence?

On comparing these two groups of cases Dr. Jenner found that, while the symptoms and *post-mortem* appearances of the 23 cases were exactly the same as those described by Louis, the symptoms, course, and *post-mortem* appearances of the remaining 43 cases were entirely different—so different, indeed, as to render their separation from the other cases a matter of absolute necessity, if accuracy was to be maintained in the description of these diseases, or certainty arrived at in their treatment.

Causation, also, as a ground of distinction between the two fevers, is a condition upon which much stress has been laid by Dr. Jenner, and subsequently by Dr. Murchison. Dr. Jenner was the first to argue that the material media by which the two fevers are propagated are specific and different from each other, according as they are generated by the bodies of those affected with the one or the other form of fever. This argument he based upon the circumstance, that because *certain local foci* sent *typhoid* cases to the hospitals, and *certain other local foci* sent *typhus* cases there, he inferred that different specific causes existed in each focus. Dr. Murchison has also clearly stated the evidence of many other observers, which goes to prove that the two fevers have no community of origin. (*Continued Fevers of Great Britain*, p. 588.)

This brief history of the progress of our knowledge regarding typhus and typhoid fevers has been mainly condensed from an erudite and most interesting monograph on “The Diagnosis of Fevers,” by Dr. Parkes, which appeared in the *Medico-Chirurgical*

Review for July, 1851—a contribution not of less importance to science than the original investigations of those whose labours it records; for it connected the scattered observations together, and showed at once the practical value of the discovery that had been so gradually made—tending, as it did, to bring conviction to the minds of those not fully conversant with the literature of the subject, and with what had actually been achieved in different parts of the world. To Dr. Parkes, the clear, elaborate, and careful analysis he made was a labour of love—justly believing, as he does, that no subject is so important as an accuracy of diagnosis. It is the foundation of therapeutics; and he who clearly indicates how a disease can be recognized is fellow-labourer to him who points out how the disease may be cured or prevented.

This brief history also teaches us how slow is the progress of discovery. The greatest discoveries have been rarely due to any single individual; but gradually, slowly, and surely the Light of Science dawns upon the world. It was so with the discovery of the Circulation of the Blood. It was so with the discovery of the Protective influence of Vaccination. It was so with the discovery of the Powers of Steam, and the development of the steam engine to its present condition of perfection.

Since 1851 proofs of differences between the two fevers have been still accumulating in many different directions. They especially result from the observations of Dr. William Budd, of Clifton, near Bristol; of Dr. Murchison, of the London Fever Hospital; of Professor Wunderlich, of Leipsic; and of Von W. Griesenger, of Zurich. The observations of these latter physicians are especially valuable, as showing the ranges of temperature in the two fevers to be distinctive of two diseases. Thus the evidence has slowly but surely accumulated, so that, when the whole subject has been re-examined in all its relations, the conclusion irresistibly forces itself on the understanding, that a belief in the identity of *typhus* and *typhoid* fevers is no longer tenable.

I have hitherto, in common with many, been in the habit of recognizing the striking similarity between the two fevers, in outward aspect, in many respects, and of being unduly biassed by the resemblances, rather than giving sufficient importance to the numerous and remarkable differences between them, which are now to be described.

With regard to their most prominent points of resemblance and difference, it may be shortly stated here, that all the points in which the two fevers agree are common to them and many other diseases, and therefore are of no value as *indicia* of a species. On the other hand, the points in which they differ are all of a very special nature. The points in which they agree may all be summed up in the phrase "typhoid symptoms"—a set of symptoms which are met with in a great variety of diseases, and therefore are of no specific value in the question at issue. These so-called typhoid symptoms (represented by the phenomena of stupor, low delirium, general prostration, *subsultus tendinum*, a dry and encrusted mouth, deafness) occur not only during the course of *typhus* and *typhoid* fevers, but are also found to occur and to group themselves in a similar manner in *pyæmia*, *uræmia*, some forms of *pneumonia*, and in many cases of *acute tubercle* (W. BUDD).

TYPHOID, INTESTINAL, PEYERIAN, OR ENTERIC FEVER—*Febris Typhoidea*.

Definition.—*A continued fever associated with an eruption on the skin, appearing generally from the eighth to the twelfth day, occurring in crops, each spot continuing visible about three days. Languor and feebleness are prominent from the first, attended by headache, abdominal pains and (early) by spontaneous diarrhœa. With the advance of the disease the diarrhœa increases, the discharges being for the most part liquid, copious, of a bright yellow colour, devoid of mucus, occasionally containing altered blood; in re-action alkaline, and containing a large proportion of soluble salts and some albumen. The disease may terminate favourably by a gradual restoration to health during the fourth week. The average duration of the fever is about twenty-three days. Death, in the majority of fatal cases, occurs towards the end of the third week. There are symptoms also associated with the characteristic lesion of this form of fever—namely, fullness, resonance, and tenderness of the abdomen; more or less tympanitis, with entire effacement of the natural lineaments of the belly; gurgling in the iliac fossæ; increased splenic dullness. The secondary lesions are enlargement of the mesenteric glands with deposit in the glands of Peyer and in the minute solitary glands of the small intestine.*

Pathology and Symptoms.—Typhoid fever begins gradually, often, indeed, so very insidiously that its commencement is not always able to be fixed.

This form of continued fever is described under a great variety of names, by various writers, such as *typhus mitior*; *nervous fever*; *abdominal typhus*; *common continued fever*; *enteromesenteric fever*; *dothinerteritis*; *follicular enteritis*; *bilious fever*.

The fever may be ushered in with rigors, chilliness, or profuse diarrhoea; and amongst the early symptoms, the most characteristic are the abdominal pains and diarrhoea, which continue to increase. The countenance indicates anxiety, the mind continues clear; but delirium when present is generally active. The patients are vivacious, and disposed to leave their beds. The conjunctivæ are pale, the pupils dilated, the cheeks somewhat flushed, and epistaxis not seldom occurs, at repeated intervals during the first week. The belly enlarges as in mesenteric disease, and is resonant on percussion. Gurgling on firm pressure may commonly be detected in the right iliac fossa, and there is often tenderness in the same situation. From the seventh to the fourteenth day the characteristic eruption appears. As a rule, the flushing of the face is more marked towards evening; but the complexion does not get muddy as in typhus, and the flush of the cheeks is bright and pinkish—not dark red—and is often circumscribed, and then strongly contrasts with the surrounding pale skin. During the third week the abdomen becomes more distended; the diarrhoea increases, the stools often amounting to *five, six, or even eight* and *ten* a-day. They are liquid, pale brownish-yellow, with flocculi of an opaque whitish-yellow colour floating through them, like coarse bran, and as the patient loses strength they are passed involuntarily. Pain is rarely complained of unless perforation of the gut occurs; and hæmorrhage from the bowel is an occasional symptom during the third or fourth week. The frequency of the pulse often varies much from day to day, without any appreciable coincident alteration in the general or local symptoms. It is generally soft. The tongue at first is red and fissured, but ultimately becomes dry and covered with a pale brown fur. The splenic dullness is generally increased. Pulmonic complication is not uncommon.

In cases that recover a remarkable fatuity remains behind

long after recovery; and there appears to be some diminution of intellectual power for some time after convalescence is restored. Dr. Jenner has seen many cases in which childishness of mind remained for more than a month after apparent restoration to health. The patient generally wakes up, as it were, from the fever a complete imbecile. The whole man seems changed. He seems to renew his youth. Childhood and infancy return, and the greatest care is necessary to prevent untoward events. **NO MAN CAN BE CONSIDERED AS FIT FOR WORK, OR FOR GENERAL MILITARY SERVICE, FOR THREE OR FOUR MONTHS AFTER AN ATTACK OF SEVERE TYPHOID FEVER.**

With regard to the symptoms generally of typhoid fever, it is of great practical importance to be constantly alive to the fact that no necessary connection exists between the intensity of the general symptoms of the disease and the extent of the intestinal mischief which may supervene, or the absolute danger of the case. Two cases, out of several related by Dr. Bristowe, show that the patients (men) carried on their daily avocations, so mild *seemed* the disease to be, up to the very moment of fatal perforation of the gut. Indeed, the most suddenly fatal cases seem to be the very cases in which strongly marked febrile phenomena do not occur. In a case related by Dr. Murchison, a man twenty-one years of age died on the twenty-fifth day of the fever. Up till the twenty-third day there were no symptoms to indicate danger. He suffered from very slight diarrhoea. The pulse seldom rose above 90; and the patient could get out of and into bed. About forty-two hours before death the pulse rose to 120, associated with sudden pain in the lower and right side of the abdomen. Profound collapse indicated that perforation had ensued, and death soon followed. The *very slightness of the symptoms* ought, therefore, to rouse suspicion, knowing, as we now do, that associated with the characteristic eruption the following *four* sets of phenomena may be all that precede a fatal hæmorrhage or peritonitis; namely,—(1.) An elevation of temperature towards evening of only 1° or 2° Fahr. above 98° Fahr.; (2.) Moderate increase towards evening in the fullness and quickness of the pulse; (3.) A little headache during the first six days; (4.) Scanty urine.

Again, the physician must also keep in view the fact that relapses of all the symptoms, including the eruption, not unfre-

quently supervene. He must not be betrayed into the belief that danger is past if towards the eighth or tenth day, the little headache that prevailed may pass away, and the other febrile phenomena just mentioned may subside. It is on record that events such as these have led to the belief that convalescence from a mere "febricula" had been established, leading to the discharge of the unfortunate patient from hospital. His vocation, if a soldier, would then compel him to undertake severe duties during the actual height of a severe disease, made more dangerous and perhaps fatal by such a mistake.

Another symptom, often very painful, is *meteorism*, or the accumulation of air in the large intestine. This is present in a greater or less degree in one-half of the cases, and when considerable it always marks a grave affection, and one generally fatal. On the contrary, the abdominal muscles are, in a few cases, tense, and strongly contracted. It is, however, the experience of all physicians, that there is no condition so low, and no symptoms so severe, from which the patient may not recover; and, on the other hand, there is no case of this form of fever so slight that it is to be considered free from danger. The prognosis must therefore be cautious, because perforation of the intestine may follow the mildest case, and death from peritonitis ensue.

The symptoms of typhoid fever, however, cannot be said to be fully expressed till the characteristic eruption has appeared.

The **Eruption** consists of the so-called *rose spots* peculiar to *typhoid* fever, the "*taches rosées lenticulaires*" of Louis. They begin to appear from the sixth or seventh to the twelfth or fourteenth day of the disease, very rarely later, and still more rarely at an earlier period than the sixth day. A very delicate scarlet tint of the whole skin, closely resembling the skin of a person soon after leaving a hot bath, sometimes precedes, by a day or two, the characteristic eruption of typhoid fever; and this is important to remember, because it may be mistaken for the rash of scarlet fever, especially if sore-throat is also present. The eruption consists of slightly elevated papulæ, or pimples; but, to detect their elevation, the finger must be passed very delicately over the surface of the skin; because, although pimples, they are not hard, like the first day's eruption of small-pox. Their apices are neither acuminate nor flat, but invariably lens-shaped or rounded, and the bases gradually pass into the level of the

surrounding cuticle. No trace of vesication can be detected on their apices. They are circular and of a bright rose colour, the colour fading insensibly into the natural hue of the skin around; and the margin is never well defined. *They disappear completely on pressure*, resuming their characteristic appearances as soon as the pressure is removed. These characters they preserve from their first appearance to their last trace. They leave no stain, pit, or scar behind. They vary in size, but their usual diameter is nearly two lines, but varying from 1 to 2½. The ordinary duration of each papula is about two days, but its existence varies from two to six days, and fresh ones generally make their appearance every day or two after the first appearance of eruption, and they continue to appear in successive crops till the twenty-first or twenty-eighth day of the disease. Sometimes only one or two are present at first, after which one or more fresh ones make their appearance. The eruption of such spots does not consist of a great number at one time, only from six to twenty. The eruption occupies usually the abdomen, thorax, and back; but is sometimes present on the extremities, and is sometimes, though rarely, so thickly seated that scarcely an interval of normal cuticle is left between. **THIS SUCCESSIVE DAILY ERUPTION OF A FEW SMALL, VERY SLIGHTLY ELEVATED, ROSE-COLOURED SPOTS, DISAPPEARING ON PRESSURE, EACH SPOT CONTINUING VISIBLE FOR THREE OR FOUR DAYS ONLY, IS PECULIAR TO AND ABSOLUTELY DIAGNOSTIC OF TYPHOID FEVER.**

The eruption is, however, often so scanty that the physician may justly hesitate for a day or two to make a diagnosis. The first crop of the eruption is rarely quite decisive; but as soon as successive crops, even of two or three spots each, appear, all doubt is removed. When the eruption is scanty it is advisable to surround each individual spot with an ink line in such a way as to distinguish accurately the period of its appearance (W. T. GAIRDNER.)

It is the occurrence of this eruption which clinches the diagnosis. It becomes absolute, as regards typhoid fever, when in a febrile disease attended by diarrhoea, or simply looseness, unequivocal rose spots appear on the sixth or eighth day. If they do not appear, then the diagnosis cannot be said to be complete, till the case has been watched for several days, and the age of the patient and the history of the illness has been fully

and carefully studied. In children between *one* and *five* years of age the phenomena do not seem to be so easily observed as in adults.

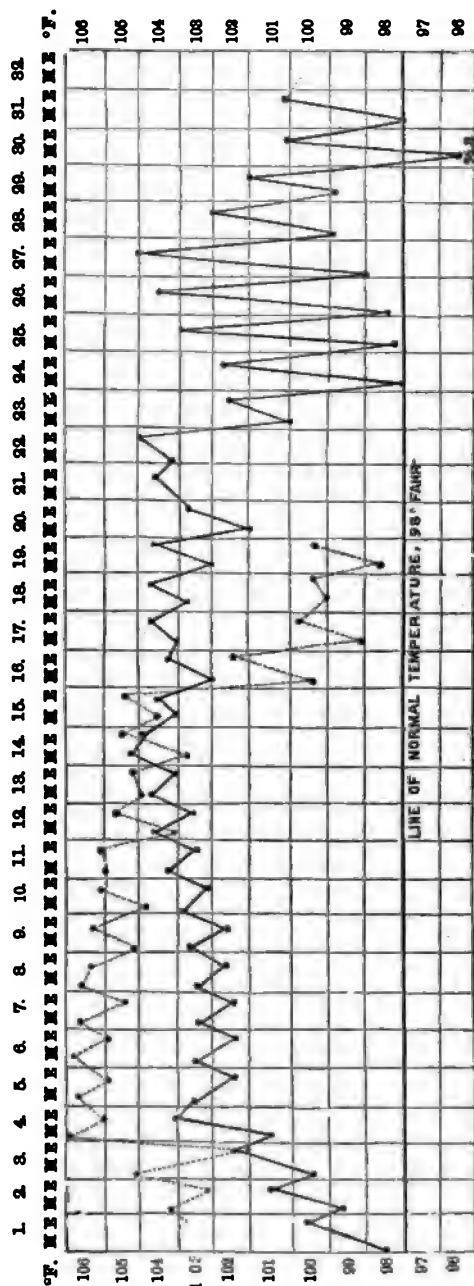
It has been now clearly established that typhoid fever is by no means an unfrequent disease amongst children. Boys seem to be more liable to attack than girls. It is most frequent between six and eleven years of age; and from five to nine seems the period of greatest liability. Its occurrence is rare during the first years of life. Nevertheless, it is on record at the following very early ages—namely, between two and three months; three months; six months; seven, ten, and thirteen months (WUNDERLICH, HENNIG, FRIEDRICH, RILLIET). The author of a very interesting Review on the typhoid fever of children in the *Brit. and For. Medico-Chirurgical Review* for July, 1858, p. 161, mentions in his own experience the occurrence of typhoid fever in a girl one year and seven months old; and also in a boy two years of age.

The chief symptoms of typhoid fever in the child are,—splenic enlargement, diarrhoea, meteorism, gurgling in the course of the colon; associated with pyrexia, quickened respiration, bronchial catarrh; delirium, somnolency. The eruption, already described, and sudamina, are nearly constant in children after five years of age. The rose-coloured spots are especially frequent on the back and the extremities, so that if the abdomen and chest only are examined, their presence may often not be apparent.

The Temperature during Typhoid or Intestinal Fever.—Wunderlich has given a summary of results derived from the observation of 700 cases of typhoid fever, investigated thermometrically. (*Arch. der Heilk.*, vol. ii, 1861, p. 433; also, *Ed. Med. Jour.*, Nov., 1862, p. 465.)

The course of the disease is typical, and the type is characteristic; and when irregular cases occur, irregularity may in general be traced to a special cause. The mode of accession is pretty nearly the same as in much more severe cases. For about three days increase of temperature in the evening and remissions in the morning follow one another, the temperature every morning and every evening being about $2^{\circ}2$ Fahr. higher than on the preceding morning and evening, while the morning temperature is generally about $1^{\circ}1$ lower than that of the previous evening; or, according to the following formula:—

TYPICAL RANGES OF TEMPERATURE IN CASES OF *TYPHUS* AND *TYPHOID* FEVER CONTRASTED WITH EACH OTHER THROUGHOUT THEIR COURSE, FROM THE BEGINNING TO THE END OF THE DISEASE. THE RECORDS INDICATE MORNING (M.) AND EVENING (E.) OBSERVATIONS. THE *dotted lines* indicate the *Typhus* range; the *continuous dark lines* indicate the range in *Typhoid* (WUNDERLICH and TRAUBE).



First day, morning, $98^{\circ}5$; evening, $100^{\circ}5$: second day, morning, $99^{\circ}5$; evening, $101^{\circ}5$: third day, morning, $100^{\circ}5$; evening, $102^{\circ}5$: fourth day, morning, $101^{\circ}5$; evening, 104° . In the second half of the week the evening temperature is from 103° to 104° , the morning temperature about a degree lower. On the third or fourth day the fastigium or height of the fever is attained when the temperature in the evening amounts at least to $103^{\circ}5$ Fahr. From that time onwards the fever proceeds in regular stages of weekly and half-weekly periods. When the temperature on the first or second day reaches to 104° , or where in a child or in an adult the evening temperature between the fourth and sixth days does not rise to 103° , where, in the second half of the first week there is considerable abatement of the evening temperature, we have in such cases certainly *not to do with typhoid fever*; on the other hand, the disease may always be recognized when there is in the evening hours a persistent elevation of temperature. During the second half of the first week both mild and severe cases follow the same course, so that for the purposes of prognosis the determination of temperature is of little consequence during the first week. In the second week typhoid fever may be excluded with the greatest probability, if between the eighth and eleventh days the temperature is below 103° . Such a temperature is rarely met with at this period in any other disease, and where it occurs, unequivocal symptoms will certainly be present. It is only in the maxima of the temperature that sometimes a difference is visible between very mild and very severe attacks. In the mild cases there is now and then a large decrease of temperature observable towards the end of the first week—namely, from $105^{\circ}8$ to perhaps $102^{\circ}5$. At the beginning of the second week, or at the latest during its second half, severe and mild cases diverge so unmistakably that the course at that period is decisive as regards what the future progress will be. A favourable course during the second week permits us to anticipate a favourable termination of the disease. In mild cases (analogous to those of modified small-pox), although the evening temperature may reach 103° , and even exceed 104° , considerable abatements (1° to 2°) take place during the morning, which become more and more obvious towards the end of the second week.

Such mild cases also progress favourably when the exacerbations do not begin before ten o'clock in the morning, so that before midnight an abatement takes place; when these conditions remain daily the same, or when a diminution of temperature shows itself, although not more than half a degree; and, lastly, when there is an abatement on the eleventh, twelfth, and fourteenth days. A retardation of recovery until at least the fourth week, is to be anticipated, when in the second week the morning temperature is above 103° and the evening above $104^{\circ}5$; when the exacerbations occur early in the forenoon and remain after midnight; and, lastly, when a fall in temperature about the middle of the week does not take place.

A permanent temperature of 104° is an unfavourable sign—so also is an elevation of the morning above the evening temperatures. A severe form of the disease is to be expected when the morning temperature at the beginning of the second week is above 104° , and when the evening reaches nearly 106° ; and when towards the end of the week a rise still takes place. The most unfavourable cases are those where, in addition to these unfavourable conditions, oscillations are added, even if these consist in diminution of temperature.

In the third week the patient enters upon those highly characteristic quotidian vacillations of 4° , 6° , and even more degrees Fahr. between the morning and the evening temperatures. If the case is mild the evening exacerbations gradually decrease in intensity, and the morning temperature is regularly at first from 3° to 4° below the evening. The fever ceases in the course of the week, the temperature reaching its natural standard, and convalescence commences, as a rule, sometimes in the third week, generally in the fourth week, or at the latest in the fifth week.

In severe cases the characteristics mentioned as peculiar to the third week already commence in the second. The temperature in the mornings is high (104° Fahr. and more), and differs but little from that in the evening; or even that high temperature increases in the afternoon and evening to a still higher degree. In this it differs from a remission of the fever in a mild case, inasmuch as in remissions the heat in the mornings sinks below the average degree of temperature in typhoid cases—*i.e.*, below

103°·3 Fahr. to 104° Fahr. In severe cases, on the contrary, the temperature always remains above the average degree, and rises still higher in the evening. Real remissions in such cases are not met with during the whole of the second and third weeks; but when the case is favourable although severe, the temperature is about a degree lower than in the second week, and the remissions do not take place till the fourth week; and if the temperature remains as high, or rises higher than it was in the second week, the remissions do not occur till the fifth week, and irregularities in the ranges of temperature always render the prognosis doubtful.

So late as the fourth week the evening temperatures are still high, and they decrease very gradually even in favourable cases. Towards the end of the fourth week, or in the fifth week, or even so late as the sixth week, the great and increasing remissions commence—a period at which various other phenomena occur, and when the complications and dangers are numerous.

The complications generally make their appearance about the third week, and threaten or tend to a fatal end up to the very beginning of convalescence. In the mild types the deposits in the intestines are no doubt such as are eliminated by mere rupture of the vesicles, and simply heal without ulceration. The severe cases owe their severity partly to extensive growth of new material in the vesicles of Peyer's glands, partly to the mode of elimination of that material; the healing of the parts being accomplished under great excitement of vascular re-action, renewed hyperæmia, sloughing, softening, and final cicatrization.

Cases intermediate in severity between the mild and severe cases just described are not unfrequently met with. Many of them, although they show a course more or less irregular, nevertheless follow a pretty clearly defined type as to variations of temperature, and are capable of clinical recognition. There are still considerable evening exacerbations during the second week, yet with a tendency to abatements in the mornings. During the third week great vacillations between morning and evening temperature continue, and sometimes also between single days. During the fourth or fifth week the normal temperature is reached in the morning; but it is only in the fifth or sixth week that the

temperature becomes permanently normal—the evening temperature showing a complete freedom from fever—so that the beginning of convalescence can only be established with certainty by the use of the thermometer.

In the majority of cases of typhoid fever, severe as well as mild, a peculiar periodicity of weeks and half weeks cannot be mistaken. Each week shows a distinct character, which cannot be overlooked in a graphic representation. On the first and last days of each week, changes generally take place which are either temporary changes, or continue till the fever subsides.

The mode of recovery, or the transition into the feverless state, is also peculiar and characteristic of enteric fever. With rare exceptions, the defervescence is a remittent one. The great vacillations between morning and evening recur for a longer or shorter interval. For weeks the evening temperature may amount to 104° Fahr. or more, whilst in the morning the patient is quite free from fever. At the same time the transition into the feverless condition may follow different courses. The remissions may either become longer and longer—the morning temperature decreasing and the evening remaining stationary; or after some time the remission may become shorter and shorter—the evening temperature together with the morning temperature gradually descending. Again, the differences between the morning and the evening temperatures may remain nearly the same, while a relative decrease takes place at both periods; or the fever shows a sudden transition into the remissions with low temperatures—changes which generally correspond with the commencement of weeks. The period of development of the disease occupies two weeks, or a week and a half in slight cases; in severe cases it may occupy two and a half to three weeks. The initial stage (that is, the period when the growth of material in Peyer's patches takes place) lasts about half a week. The removal or elimination of the growth may take place in a week; but the process may extend over several weeks. In mild cases the disease continues at its height for only a week or a week and a half, rarely for two weeks; so that the whole duration of a mild case of typhoid fever extends from eleven to eighteen days. The period of convalescence occupies from one to two weeks. The whole disease, therefore, in mild cases, may be

gone through in from three to four weeks, rarely in two weeks and a half.

In severe cases the disease continues at its height for from two weeks and a half to three weeks and a half. Then an undecided period of irregular duration succeeds, after which decided abatement is established, the defervescence occupying a week, followed by another week of convalescence. Consequently the whole disease extends from four and a half to ten weeks, or even longer.

In particular cases following a spontaneous course, and still more in cases treated with calomel, a considerable shortening of the whole febrile period will not only be observed, but some peculiar modes of defervescence will occur. The temperature is reduced where calomel acts beneficially; and the beneficial remission is persistent.

The influence of hæmorrhage from the bowels in reducing temperature has been also well shown in a case recorded by Dr. Parkes. It occurred in a female twenty-five years of age. Diarrhœa was considerable; and blood was largely passed in fluid stools, the night before the seventeenth day of the fever. On the morning of the seventeenth day the temperature was as low as 93° Fahr., rising in the evening to about 101° Fahr. After the eighteenth day diarrhœa ceased; but the differences between the morning and evening temperatures continued to be very great; and it was not till the twenty-sixth day that these differences began to grow less and less.

The approach of death is indicated by a permanent or persistent elevation of temperature in the morning (as high as 106°); by a sudden rise to 108° or even higher; and more seldom to a depression below 93°.

Condition of the Urine in Typhoid Fever.—It is not till the third or fourth day of the fever that the urine assumes any special characters. It is peculiar in the following respects:—

I. As to normal constituents:—(1.) *The water* is greatly diminished, generally about one-half, or even to one-fourth or one-sixth. This lessening of the water is most marked during the first week; it then begins to increase gradually during the second and third weeks; and at the end of the fourth week, in favourable cases, it has reached its normal standard. (2.) *The whole amount* of the urine does not seem to stand in any close relation to the febrile

heat; but when the temperature begins to fall permanently the urine increases at once, or very soon after. (3.) *The specific gravity* of the urine is high in almost all cases where the urine is scanty; and at convalescence the specific gravity diminishes, sometimes before the amount of water increases; *i. e.*, at convalescence the lessening of the solids of the urine is often prior to the increase in the water. (4.) *The urea*, as a rule, seems to be augmented during the febrile period above the physiological standard proper to the individual; and it sinks again below this standard during convalescence. The amount of increase varies: Vogel has noted 78 grammes or 1,200 grains in 24 hours; while Parkes has noted 57 grammes or 880 grains in that time. In most of the cases observed by Dr. Parkes the average increase has been about one-fifth above the physiological standard proper to the individual; and the augmentation is most marked in the first week, when the water and the chloride of sodium are at the lowest point; and if the fever be continued beyond the third or fourth week, the urea keeps up in amount. The relation of urea to temperature is yet uncertain. (5.) *The chloride of sodium* is diminished (indefinitely); the cause of the diminution being in part due to the lessened ingress of this substance on account of spare diet; or due to the elimination of large quantities of it with the stools or the sweat. (6.) *The uric acid* is uniformly increased in amount; and it is relatively greater than that of the urea. It is often doubled in amount; and the increase progresses up to the fourteenth day, when it is at its greatest. It then diminishes to the twenty-first or twenty-eighth day; and during convalescence falls below the normal amount. Spontaneous deposits of urates occur very frequently; and when there is no such deposit it may be brought about by a drop of acid; but as yet the fact has no particular significance. (7.) *The sulphuric acid and phosphoric acids* maintain their amounts very much the same as in health; and sometimes a little above that: and seeing that much of the former is derived from food, its abundance in typhoid fever would indicate active tissue change, when little or no food is being taken. (8.) *The pigment* at first is sometimes enormously increased, measured after Vogel's method (by comparison with a scale of colours). It has sometimes amounted to 80 or 100 in 24 hours, the normal amount being 3 to 6 (VOGEL). This, Dr.

Parkes says, is to be referred to increased disintegration of blood cells; it is therefore much more highly coloured than the mere concentration will account for. (9.) *The acidity of the urine* appears always great during the early period, simply from concentration; but, by neutralization with an alkali, it is found actually to be below the average by one-fifth, or even by one-fourth. During the third week the acidity still continues to lessen; and ultimately the urine may even become alkaline from fixed alkali. It may also become alkaline from ureal decomposition, soon after being passed. Therefore it is necessary, in all observations on this point, to distinguish carefully between the alkalinity due to fixed alkali and that due to ammonia.

II. As to abnormal constituents:—(1.) Albumen occurred in 33·3 per cent. of the cases examined by Dr. Parkes. In 23 per cent. of these cases it was temporary, and entirely disappeared before the patients left the hospital. In the other cases it was permanent; and in one of these a very profound kidney lesion which had not previously existed was immediately excited by the fever. (2.) Renal epithelium, casts, and blood are sometimes seen in the cases with temporary albuminuria—the blood generally in microscopic quantities; although in bad cases it may be greater in amount. Dr. Parkes (from whose work *On the Urine* those statements are taken) goes on to show how different phenomena in the course of typhoid fever variously affect the urine. The effect of diarrhoea is to diminish both water and solids, the chloride of sodium especially. Non-excretion of urine, or deficiency in its solid matters, often coincides with the putrid, adynamic, or profound “typhoid” state, and with symptoms which imply more or less blood poisoning from retention. Local lesion in the kidney may lead to this, or from failing circulation, less blood may pass through the renal vessels, or there may be, as Dr. Parkes suggests, some special condition or combination of urea which hinders transudation. Such non-excretion is most apt to supervene during the third or fourth week, when the first stage of the disease is over, and when the growths in Peyer’s glands and in the mesenteric glands are softening, when the secondary blood poisoning occurs, and when the heart’s action tends most to fail.

Judging from the urine alone, the febrile action appears strongest in the first week of enteric or intestinal fever (typhoid),

although the temperature is highest in the second and commencement of the third week.

The prognosis in severe typhoid fever has appeared to Dr. Parkes to be more favourable in proportion to the free excretion of urea and uric acid. The excretion of these effete products is a most necessary point; for there is more danger *in their retention* than in any amount of fever and *formation of them with elimination*. The greater the excretion in typhoid fever the better; and as long as 500 to 700 grains of urea in men, or 300 to 500 in women are being passed in each twenty-four hours, the progress so far is favourable. But whenever, while the fever continues, the urea falls much below these amounts, we may anticipate a low typhoid condition, or some local inflammation, as pleurisy, which may relieve the blood for a time from some of the effete products.

The existence of slight albuminuria or hæmaturia is not of itself unfavourable; but if either be in large amount, or if there be exfoliation of epithelium or renal cylinders present in the urine, retention of urea and its consequences may be expected.

Morbid Anatomy of the Lesions in Typhoid Fever, with special reference to the Phenomena and Progress of the Disease.—The abdominal complications of typhoid fever, as they are sometimes called, are mainly due to lesions of the solitary and aggregate glands of Peyer, and to enlargement of the mesenteric lymphatic glands. This lesion in the ileum is especially recognized as the “anatomical sign” of enteric or typhoid fever. It is necessary to remember, however, in connection with the age of typhoid fever patients, that the solitary vesicles and the aggregate glands of Peyer are known to be most fully developed and most active in youth up to the age of early manhood; after that time they begin to disappear, and are obviously less active in the adult after thirty years of age. Structure and function seem to be alike impaired by age, till at length, after forty or forty-five years, traces only of their existence are apparent, or they have altogether disappeared. The gland substance (whose structure has been so well described by Dr. Allen Thomson, Kölliker, and Boehm) no longer exists; and the places where the patches of Peyer once were may be detected only after careful examination, —a mark of varied form and character being all that indicates

the place of the patch. There is therefore a good anatomical reason why typhoid lesions are rarely found after fifty-years of age, and seldom after forty. Dr. Jenner records only three cases beyond fifty—namely, one at fifty-one and two at fifty-five. Dr. Wood has observed one case at fifty-five years of age. Dr. Murchison notes two cases above sixty-five, and refers to five other cases between sixty and seventy-five, related by M. M. Lombard and Gendron. Dr. Wilks refers to the case of a woman aged seventy, of very doubtful history. (*Path. Society*, 1861.) These exceptional cases are explicable when it is known that the existence and functional activity of these glands are sometimes prolonged for an indefinite term of years beyond the usual period of their existence. On the other hand, it is in childhood and early life that these glands are most obvious and their functional activity the greatest; and therefore it is extremely interesting to find that “more than one-half of the cases of typhoid fever occur between fifteen and twenty-five years of age; and in very early life the proportion of cases of typhoid fever would be greater were it not that many children labouring under this disease are described as cases of ‘*Infantile Remittent Fever*’” (MURCHISON).

The following records with regard to the age of typhoid fever patients, collected by Dr. Murchison, demonstrate these points:—

PER CENTAGE OF CASES OF TYPHOID FEVER AT DIFFERENT AGES.

Under Ten Years,.....	6·04
„ Fifteen Years,	20·14
From Fifteen to Twenty-five Years,.....	52·08
Twenty-five Years and upwards,.....	27·76
Thirty „ „	14·22
Forty „ „	5·19
Fifty „ „	1·46
Sixty „ „	0·5

The average age of typhoid fever cases is $21\frac{1}{2}$; and the fever is pre-eminently a disease of childhood and adolescence.

Lesions in Typhoid Fever.—Of these the most noticeable are to be seen in the intestines, and may be considered in the following stages:—

I. *A generally congested state of the mucous membrane of the intestines, especially expressed in the vicinity of the solitary glands, which are surrounded by vascular rings, and clustered*

*groups of vesicular glands which constitute Peyer's patches.** This vascularity seems to be very general, involving more or less of the abdominal viscera. Sensations of heat and abdominal distress are associated with this morbid state, and the lineaments of the belly are obliterated.

II. *Associated with this congestion, the gland vesicles become obviously prominent.* Increased growth of the gland cells occurs till the closed sacs of the glands become filled up with crude material. This condition is sometimes described as *intumescence* of the glands; and with the congestion just noticed constitutes the stage of "*infarction*" as described by the older authors. Symptoms denoting intense irritation of the mucous membrane—*catarrhal* and *gastric* symptoms—prevail; and the mucous membrane generally is swollen and turgid, especially the villi of the intestines which are particularly distinct, imbedded in a thick layer of dirty yellow gelatinous mucus. Although these condi-

* The following tabular statement of the anatomical forms of the glands which compose the substance of the mucous membrane of the alimentary canal is mainly condensed from a careful description of them by Dr. Allen Thomson, Professor of Anatomy in Glasgow, published in *Goodsir's Annals of Anatomy*, vol. i., p. 33, and from the descriptions of Kölliker. The nomenclature is definite, and distinctive of the various forms of the glands; and it will be adhered to in all the future descriptions of lesions of the mucous membrane of the intestines. Much confusion prevails from the indifferent use of the terms vesicle, tubule, follicle, &c., as applied to the mucous glands in descriptions of the lesions in dysentery and fevers; therefore, it is considered necessary to explain exactly at the outset the nomenclature adopted in the text.

I. VESICULAR LENTICULAR, OR PIMPLE-LIKE GLANDS—Usually closed.

(a.) Solitary—*e. g.*, in the palate, buccal membrane, œsophagus, and stomach; also found deeply imbedded in the great gut, and scattered more near the surface of the small gut.

We know nothing about the comparative abundance of these glands in a healthy intestine; nor are we certain whether or not they disappear after a certain age, like the vesicles which compose Peyer's patches. Many of the so-called solitary glands seen in disease may be in reality new formations. At all events, they occur in much greater numbers in certain diseases than their known frequency of appearance in the healthy intestine would lead us to expect.

(b.) Clustered in groups—*e. g.*, Peyer's patches of glands in the ileum.

II. FOLLICULAR OPEN GLANDS OR CRYPTS—A transient condition of the vesicular glands, after rupture and discharge of their contents—*e. g.*, great gut and stomach.

III. TUBULAR GLANDS—Occur in the small and large intestines, as the so-called follicles of Lieberkühn; and in the stomach, as the stomach tubes.

IV. RACEMOSE GLANDS—Consisting of tubes with simple sacs or vesicles, in clusters round a stalk or duct—*e. g.*, the cardiac œsophageal glands, and the duodenal glands of Brunner.

tions seem to involve the whole of the mucous membrane in the first instance, yet they soon begin to be more expressed towards the lower end of the small gut than in any other part. The time at which this deposit or increase of cell growth commences in these glands is not yet well defined. It seems certain, however, that it occurs within the first week; but it may be later. A case is described by Dr. Sankey in the first volume of the *Pathological Society's Transactions*, in which dissection showed the deposit in the glands as early as the fifth day. The bulging of the patch and the extent of intumescence varies considerably in different patches; and simultaneously with these conditions the mesenteric glands begin to increase in size. They, too, are supplied with an increased quantity of blood, and the increased tissue of the gland becomes unusually soft and elastic.

III. *A subsidence of the general congestion, and of the generally turgid state of the mucous membrane, takes place after the gland growth has been fully developed.* Nevertheless, the growth continues actively and progresses rapidly, till the patches of Peyer become so thick as to be elevated three or four lines above the surface of the mucous membrane. A beautiful vascular halo encircles them, stopping short at their margins; and a contracted border surrounds the margin of the patch, which gives it a sessile fungiform aspect, with an umbilicated-like depression on its surface. Growth is now confined within narrow limits, pressing on the muscular coat below and the mucous coat above. The patches assume various aspects as to colour; and, when vascular, they have an appearance which has acquired for them the description of being like "fleshy lumps;" their grey and tawny colour being visible through the peritoneum of the gut. Varicose vessels abound in the vicinity,—a fact of some importance in connection with the formation of thrombi, and which may lead to the formation of hepatic or pulmonary emboli. The specific gravity of the mucous tissue of Peyer's patches is obviously changed by such increased growth, ranging from 1·032 to 1·044.

IV. *Softening of the contents of the tumid gland cells* seems to be the next event in the series, and which would appear to be preliminary to one or other of the following results, namely:—

V. *Conditions under which the softened contents of the glands begin to be eliminated.* This elimination seems to take place in one or other or in each of the three following ways: conveying

out of the body by the intestinal discharges abundance of morbid material, presumed, with great probability, to contain the specific virus of the fever:—

1. Elimination without ulceration; but simply by the rupture of the hitherto closed gland vesicles. This is simply the usual and natural way in which the vesicles of Peyer's patches become open follicles in the course of their normal physiological existence. For many reasons I am induced to believe that this is the natural, the most common, and the most frequent mode by which the softened new growth in typhoid fever is got rid of—namely, by the escape of the softened contents of the glands through the rupture of the vesicles in the ordinary way. The vesicles then collapse, and assume the appearance of little pits, depressions, or follicles, and so give rise to that "reticulated indistinctly pitted surface" so often seen after all evidence of gland structure has disappeared. This view is also consistent with the observation of Wedl, when he says that "the glands in question not unfrequently burst; and the capsules also may collapse, in consequence simply of absorption of their contents. Owing to one or other of these occurrences, the Peyerian patches acquire the well-known reticulated aspect, since the mucous membrane surrounding the individual capsules assumes the form of a projecting border; and entire patches present the appearance of a fine sieve." (*Pathological Histology*, p. 221.) The ordinary peristaltic action of the intestines may assist this mode of elimination by rupture of the vesicles, if the softening is complete. One case I dissected at Scutari led me first to this conclusion. In this case a process of growth and elimination seemed to have gone on for at least one month previous to death; and the elimination of the material from the patches took place without ulceration. The man died suddenly from aneurism of the aorta. A lull in the febrile symptoms had led to his premature discharge from hospital; and the day on which he suddenly died was to have witnessed his embarkation for England. Peyer's patches were in an extremely interesting condition. They were all large and obvious. In some parts of them the vesicles were greatly distended with the material of growth, in a milky-like condition; while other parts of the same patch were completely bare, and dotted over with minute points of black pigment. These parts were quite bare of all gland structure, and had a reticulated appearance.

In corroboration of this view, it is to be observed, further, that Dr. Friedrich, of Dresden, considers the elimination of the deposit from the Peyerian patches in the typhoid fever of children, by the formation of sloughs and ulceration, as extremely rare. For the most part, only single follicles [vesicles?] in the glandular assemblage are infiltrated, and these, either from resorption of the infiltrated material, or more often from rupture of the follicle [vesicle] within the intestinal canal, *revert to a normal condition, without the formation of any cicatrix.* (*Brit. and For. Med.-Ch. Review*, July 1858, p. 162.)

2. Elimination by ulceration of the swollen gland vesicles in groups of various sizes, involving in ulceration more or less of surrounding tissue, and tending to induce perforation of the gut or peritonitis. Considering the severe nature of this lesion, and taking into account the fact that a large proportion of cases of typhoid fever recover, it seems to me that this is a mode of elimination which occurs much less frequently than the mode already noticed. Of course, it is the state most frequently met with after death, for ulceration of Peyer's patches is the characteristic "anatomical sign" of typhoid fever. The time of commencing ulceration of the mass appears to be about the ninth or tenth day (MURCHISON); and the softening which precedes ulceration is associated with a return of the violent congestion to the small intestines, when the veins especially seem to be filled with dark-coloured viscid blood. The outbreak of the ulcers is always characterized by an aggravation of the original symptoms, after it may have been sanguinely supposed that convalescence had decidedly taken place. But in such deceptive convalescence the abnormal temperature is maintained, showing with absolute certainty that the fever is not at an end. The ulceration therefore is usually denoted (*a.*) by a re-accession of the febrile phenomena, with or without diarrhœa; (*b.*) by abdominal pains and tenderness. Judging from *post-mortem* examinations, the ulceration seems to commence at the lowermost patches in the glands nearest to the cœcum, and the ileo-cœcal valve is often implicated in the destruction. The ulcers vary in number and in extent; and although there is a tendency to perforation of the gut in fatal cases, yet actual perforation is not common, and peritonitis may supervene without perforation having actually taken place. Very various statements are made concerning the

tendency of typhoid ulcers to perforation of the gut and the frequency of this lesion with peritonitis. Perforation is said to be rare in the Northern parts of Europe (HUSS); but from the records of Drs. Murchison and Bristowe, it appears to be a more frequent mode of fatal termination than has been commonly supposed.

Of fifty-five fatal cases, perforation occurred in eight (LOUIS); of fifteen fatal cases, perforation occurred in three (MURCHISON); of sixty-three fatal cases, perforation occurred in twelve (London Fever Hospital Records); of fifty-two fatal cases, perforation occurred in fifteen (BRISTOWE).

From these data it appears that perforation occurs in about one in five fatal cases; and the perforation generally takes place through the ileum near the valve. *Post-mortem* examination often discloses vigorous attempts on the part of neighbouring structures to limit by union and adhesion the results of perforation, obviously indicating in practice the necessity of absolute rest throughout the disease.

The characters which distinguish the ulcers of typhoid fever from other ulcers of the intestines may be stated as follows:—(1.) They have their seat in the lower third of the small intestine, their number and size increasing towards the ileo-cæcal valve. (2.) They vary in diameter from a line to an inch and a half; but a number of ulcers may unite to form a mass of ulceration several inches in extent. Such extensive masses of ulceration occur close to the cæcum. (3.) Their form is elliptical, circular, or irregular—elliptical, when they correspond to an entire Peyer's patch; circular, when they correspond to a solitary gland; and irregular, when they correspond to a portion of a Peyer's patch, or when several ulcers unite to form one. (4.) Elliptical ulcers are always opposite to the attachment of the mesentery. (5.) The ulcers never form a zone encircling the gut, as may sometimes be seen in the case of the tuberculous ulcer, but their long diameter corresponds to its longitudinal axis. (6.) Their margin is formed by a well-defined fringe of mucous membrane, detached from the submucous tissue, a line or more in width, and of a purple or slate-grey colour—an appearance best seen when the bowel is floated in water. (7.) After separation of the slough there is no thickening or induration of the edge of the ulcer, as in the case of the tuberculous ulcer. (8.) Their base is formed by a delicate

layer of submucous tissue, or by the muscular coat, or occasionally by nothing more than peritoneum. (9.) There is no deposit of morbid tissue or new growth at the base of the ulcer; although sometimes fragments of yellow sloughs may be seen adhering to both the base and edges (MURCHISON, p. 547). The ulcers also are known to heal. Their cicatrices have been seen four, five, and thirty years after known attacks of typhoid fever (ROKITANSKY, BARRALLIER). And in cases where death occurs during a relapse, the cicatrices from the first attack may be found coexisting with the fresh growth in the vesicles, and with the recent ulcers of the relapse. As a rule, the reparative process does not commence till the end of the third week of the disease; and in one case where the primary fever lasted three weeks, and where death occurred from complications about the fortieth day, all the ulcers in the ileum were cicatrized (MURCHISON).

Cicatrization commences by the growth of a thin delicate shining layer of new growth, which covers the base of the ulcer, and is also attached to the basement membrane of the mucous coat. The fringe of mucous membrane becomes adherent to this new tissue, from the circumference towards the centre, until the healthy mucous membrane merges insensibly into the serous-looking lamina. The new film of membrane cannot at first be moved upon the subjacent coat, but after a time it becomes movable, and, according to Rokitansky, even becomes covered with villi (MURCHISON). There is no evidence of the vesicular gland structure ever being restored. The resulting cicatrix is slightly depressed, firmer, less vascular, and smoother than the surrounding mucous membrane. The bowel appears thinner at this part when examined by transmitted light. The depressed spot is never surrounded by any puckering, nor does it ever cause any diminution in the calibre of the gut.

3. Elimination of the typhoid growth by sphacelus of large masses of Peyer's patches. The whole gland substance implicated is involved in the destruction. The cell growth in the vesicles suddenly becomes so excessive that a condition is at last reached which is incompatible with the maintenance of life. The growth actually chokes itself; and the whole mass, or a great part of it, softens and dies. Such sphacelus has been known to happen as early as the twelfth day; but the process is generally more slow. A dirty yellow-brown slough forms, varying in thickness, and

sometimes extending as deep into the substance of the gut as to expose its muscular layer on separation of the mass. There is a tendency to bleeding on separation of the sloughs; and such hæmorrhage occurs in about one-third of the fatal cases; and the frequent repetition of such hæmorrhages during life has a marked influence in modifying the febrile phenomena. For example, in a case described by Dr. Parkes, in which the temperature was very carefully recorded three times daily, it was observed to fall *below* the standard of health, on the fourteenth and fifteenth days, slightly; on the sixteenth day, to the extent of 4° below 98° ; on the seventeenth day, to the extent of 5° ; on the twentieth day, to the extent of 2° . These falls of temperature were all traceable to the influence of repeated hæmorrhages from the bowels. The occurrence of hæmorrhage is always a most alarming symptom, and is most frequent during the third and fourth weeks of the disease. It varies in amount from a mere stain to a large quantity of blood, sometimes discharged in clots, and generally of a red colour, in consequence not only of the rapidity with which it is passed out, but also, as Dr. Parkes has shown, in consequence of the alkaline re-action of the contents of the intestine. It may cause immediate death by syncope; or by reducing the temperature and strength of the patient, he may sink exhausted, unable to cope with the disease. Whenever, therefore, blood appears in a case of typhoid fever, it is certain that the lesions of Peyer's patches are severe.

In addition to these three modes of elimination of the new growth from the intestinal glands, there are reasons for believing that it may be occasionally re-absorbed; unless such cases where resolution, independently of ulceration, commencing about the tenth day, may not be explained by the first method of elimination I have described.

VI. The mucous membrane of the intestines having existed for several weeks in the state of irritation which has been described, and the catarrh being more or less excessive, *an atrophic condition of the intestine at last supervenes*. The mucous tubes become wasted, irregular in form and size, sometimes separated by an interstitial growth of a granular nature, their bulbous ends disappear, and the whole substance of the gut becomes so thin that it resembles a portion of thin paper rather than intestine.

The mesenteric glands are invariably enlarged. They begin to enlarge at the very commencement of the disease, and sometimes attain a very large size, and their stages of congestion, of swelling, and of subsidence, go on simultaneously with the similar changes in Peyer's patches.

The spleen is usually also greatly enlarged, varying from five or six to fourteen ounces, with a specific gravity varying from 1052 to 1059. Its Malpighian sacculi (glandular) are also intumescent.

Pulmonary lesions occur (1.) as infiltrations, or (2.) as the consolidation of pneumonia, or (3.) as portions of lung which have become carnified.

In the first-mentioned form of lesion the growth seems to commence in the terminal air vesicles, ultimately assuming the form of a miliary deposit, with a semi-transparent gelatinous appearance. It is the irritation set up by this sudden growth which generally gives rise to pneumonic consolidation. Softening and friability of the pulmonary texture is thus a very constant *post-mortem* state in protracted cases of typhoid fever. Such lesions usually supervene during the later period of the fever, and when the ulcerations of the intestines are extremely spread (Huss). In this respect only it differs from the consolidation of the lung to be described in typhus fever. This lesion has been also termed *non-granular consolidation*, dependent for its origin and development on a specific cause; and it may be observed not only in the course of *typhoid fever*, but also in *measles*, *scarlet fever*, and *small-pox*. A portion of the lung in this condition has a mottled aspect. There are patches in it here and there, varying in size from a single lobule to half, or more than half, of a lobe, of a deep bluish chocolate, violet, or purplish-slate colour, bounded by a well-defined angular margin, and crossed and mapped out into smaller patches by dull, opaque, whitish lines. These are seen to be thickened into lobular septa. Scattered in the midst of the larger patches, one or more comparatively healthy lobules are frequently found, of a pale brightish pink colour, contrasting strongly with the hue of the surrounding tissue. The pleura which covers the part may have a slight milky-like aspect (DR. JENNER). It is also extremely probable that much of these thoracic lesions in such cases may be due to the direct passage of fibrinous particles from the large veins surrounding the diseased

intestinal glands (in the case of typhoid fever); clots thus tend to form in the blood-vessels, near the site of irritation—they break up—the blood becomes contaminated, and the phenomena of *embolism* supervene. Such dangerous phenomena may be looked for about the fourteenth to the twenty-first day.

The tissue of the darker portions appears tougher than in health, presenting nearly a uniform section; there is no appearance of granules, and the part sinks in water. Dr. Jenner has injected such morbid lungs, and found that occasionally the centre of the lobule is really the point at which the diseased action is first set up. The development of the new material appears to be very deficient; molecular granular matter and delicate minute cell forms compose its structure; and the specific gravity of the part is greatly increased (1·040 or more). Its colour is generally slate-grey or flesh-like; and the lesion is commonly limited by a vascular boundary, forming something like a distinct line of separation between comparatively healthy texture and local lesion.

Carnification occurs often in considerable portions of the lung (WALSHE). The general debility of the typhoid state seems to favour the occurrence of pulmonary collapse—a condition which must not be confounded with the hepatization of pneumonia. The tracheal glands and those of the bronchial mucous membrane are also affected.

There is generally a great tendency to ulceration of mucous membranes in typhoid cases—ulceration of the pharynx occurs in about *one-third* of the cases; of the larynx and cesophagus in every fifteen cases; and the mucous membrane of the colon becomes implicated in seven out of twenty cases. Louis found the colon affected by the second week in two out of fourteen cases; by the third week in six out of twenty-three cases; by the fourth week in four out of fifteen cases; and between the fifth and tenth week in one out of two cases. There is also a tendency to pericæcal abscess, preceded by the phenomena of the morbid state known by the name of *perityphlitis*, or inflammation of the areolar connective tissue round the *caput cæcum*.

Deposit of Tubercle during Typhoid Fever.—There is still another pulmonary condition which frequently occurs in *typhoid* fever, and which may either complicate the progress of the case or come on subsequently to the fever. It is the development of

tubercle. Usually when recovery takes place from *typhoid* fever it is complete; but in some cases, especially where there is hereditary predisposition, an impetus or tendency seems to be given to the development of tubercles in the lungs. If the physical signs of bronchitis continue beyond the thirtieth day, or fourth week, combined with hurried and difficult breathing, and with the signs and symptoms of great irritation of the lungs, then there are good grounds for suspecting that the deposition of tubercle has commenced in the lungs. Dr. Stokes gives two sets of cases in which this deposit takes place. In one set a great quantity of tubercular matter seems to be formed during the existence of the typhous state; and although, sometimes, such an occurrence may not have been suspected, yet the expectoration of pulmonary calculi, at periods of different duration after the convalescence, furnish strong proofs that such a lesion had taken place. In other cases, again, the cure may be effected through absorption, or by suppuration of the minute tuberculous points over the mucous surface of the bronchia. A doubtful convalescence, a quick pulse, and a hectic state, suggest such a state of things, especially when combined with persistent bronchitis.

Erysipelas, phlebitis, parotitis, and such-like local inflammations are not uncommon in typhoid fever. Such lesions may be excited by cold simply; but the absorption into the blood of putrid substances, from the ulcerating patches of Peyer or other diseased parts, may be usually, and probably correctly, considered to be the cause of most of the secondary inflammations already noticed to occur in typhoid, enteric, or intestinal fever. Dr. Parkes considers it probable, however, that deficient urinary excretion may have a share in their production. (Parkes *On the Urine*, p. 254.)

Such are the more obvious secondary affections which may develop themselves during the progress of *typhoid* or *enteric fever*, and the derangements which these give rise to constitute new phenomena in its course. In some severe cases, however, the fever may destroy the patient in a few days, without leaving a trace of organic lesion in any part of the body.

It is also well known that the existence of local symptoms do not necessarily imply the existence of any anatomical change. There may be pain of the head and delirium, without cerebritis; cough and dyspnoea, without pneumonia; vomiting, purging, and

meteorism, without the enteric lesion. These secondary affections just noticed all arise after the fever has existed some time; and it appears now to be pretty well established that the intestinal lesion at least is a special growth, which, in cases of recovery, follows first a progressive or developmental course, and afterwards retrogrades; just as in variola we first observe the development and maturation of the pustule, and subsequently its disappearance. The same may be said of the other local lesions in typhoid fever, although the existence of a special growth is not yet so fully established in the case of the thoracic and cerebral lesions, or in the parenchymatous as compared with the mucous structures of the intestine; still, it is believed that an action more or less analogous to that which occurs in the *glands of Peyer* and the *minute solitary closed vesicles of the ileum*, occurs also in all the secondary lesions of typhoid fever in other parts (DR. STOKES). Specific characters of the elements composing the growth cannot be shown to the eye even by microscopic examination. There is nothing in it to distinguish it from other elementary morbid products which are deficient in the power of organization. Dr. Stokes gives the best illustration of its vital specific attributes, in the absence of any *physical* specific character. He says, if two specimens of pus be taken, one from a pustule of variola, the other from an ordinary ulcer; although they may appear similar, they have separate and different *vital* characters. So has the poison of typhoid fever a specific *vital* attribute peculiar to itself.

The nature of this so-called "typhoid deposit" has been the subject of much discussion. The new growth is, in the first instance, confined to the gland elements, and seems really to consist in a directly continuous development of the pre-existing cell or germinal elements of the diseased glands. Eventually it pervades the submucous areolar tissue as a yellowish-white substance, deposited in a layer beneath the gland tissue. Professor John Goodsir, in his descriptions of the morbid anatomy of the cases he dissected at Anstruther, in Fifeshire, was the first to point out that the new growth was in the first instance confined to the interior of the closed vesicles, which became much distended thereby. They ultimately burst and discharge their contents, either into the cavity of the intestine, or into the submucous tissue, if the vesicles rupture at the base, as in the severe and

unfavourable cases; and if the vesicle is completely destroyed and falls out, or if a number of them do so, a number of little pits are left, which correspond to the sites of the vesicles.

The new growth has no specific structure to distinguish it from other morbid growths (WEDL, VIRCHOW, and others); and although a specific "typhous cell" has been described and figured by Gruby, Vogel, Bennett, and others, its existence is not proven.

The development of the new growth in the glands begins like a simple hypertrophy of the gland cells. Nuclei and cells exist in great abundance, which afterwards degenerate into the abnormal diseased product of the typhoid masses. No forms arise capable of sustained existence; but a directly continuous development from pre-existing cell or germinal elements of the glands, the follicles, and the connective tissue, furnishes the material of the mass (VIRCHOW). An increase in the colourless corpuscles also takes place in the blood, and deposit of pigment in the ganglia of the sympathetic nerve system (VIRCHOW). When the gland vesicles burst, the exuberance of new growth gives a fungating appearance to the part; and when the rose-red tumor is cut into, a milk-like turbid juice exudes; and in this juice many new formed elements may be seen, consisting of cells mostly oval or angular, with single eccentric nuclei—sometimes with many nuclei. The cell contents are finely granular, and fat globules may conceal the nucleus. The growth must be examined before ulceration commences; for, as softening advances, a viscid fluid with a bloody tinge, containing fine molecular elements, is all that remains, with decaying blood and blood crystals.

Circumstances under which Death may ensue in Cases of Typhoid Fever:—

1. By poisoning of the blood generally, indicated by many symptoms which typhoid fever has in common with typhus fever, cholera, small-pox, dysentery, scarlet fever, diphtheria, ichorrhæmia. The intensity of the fever is generally great in those cases, and the fatal event occurs either at a very early period of the fever, associated with cerebral congestion, or it may occur later, when it may be supposed that the danger is past. This is sometimes termed the secondary poisoning of the blood (septicæmia), and is most likely due to the ulcerated intestines,

with the bowel perhaps on the verge of perforation. The pulse becomes rapid and small; cold clammy sweats appear, and the body begins, even in life, to exhale a putrid odour. In cases where the blood is so gravely implicated, gas has been observed to become developed during life, and has been detected in the veins at the root of the neck for some minutes before death (CLOSS, FRANK, and JEFFREY MARSTON in *Med. Times*, Feb. 7, 1857).

2. By implication of excretory organs at an early period—for example, the kidney, as denoted by albuminuria, or by bloody urine,—conditions which tend to aggravate the blood poisoning.

3. By congestions of important organs—for example, the lungs and the brain, in consequence of poisoned blood; and which congestions are still further brought about by the circulation in the blood-vessels of putrid juices, or of the substance of fibrinous debris of clots in a granular condition having formed as plugs in the varicose veins surrounding the sloughs and ulcers of the intestines.

4. By hæmorrhage from the bowels during the separation of the gland sloughs.

5. By exhaustion from profuse diarrhoea in cases where the catarrh of the mucous membrane has been excessive.

6. By peritonitis, with or without perforation of the intestines. There are two periods in the course of the fever when perforation is apt to take place. The first period is during the separation of the sloughs, about the end of the second and throughout the third week. The second period is during protracted convalescence, with atrophy of the intestine already described, and when the ulcers are in a weak atonic state, the result of intense protracted fever and profuse catarrh.

7. By peritonitis subsequent on suppuration of the large mesenteric glands, and rupture of their enclosing capsule (JENNER); or from the bursting of softened new growth from the spleen into the peritoneum (ROBERTSON, JENNER); or from ulceration of the gall-bladder. The average mortality among cases of typhoid fever appears to be about 1 in $5\frac{1}{2}$ to 1 in 6. It is considerably less in Autumn than in Spring; and is least of all in Winter. It tends to be greater among males than females; and the average age of fatal cases appears to be about 23·5, and the mortality increases to a small extent as life advances. The disease in

certain places seems never to be absent, and is invariably most prevalent during Autumn, at the time that diarrhoea is most common; and it has been observed to be especially prevalent in seasons remarkable for their high temperature (MURCHISON).

Duration of the Attack of Typhoid Fever.—Regarding the mean duration of illness in *typhoid fever*, considerable differences of statement are to be found—a circumstance not to be wondered at when the nature and seat of the pathognomonic lesions of this form of fever are recognized as influencing the duration of the disease.

Dr. Shattuck assigns the mean duration of <i>typhoid fever</i> to be	22 to 24 days.
The mean duration of the Parisian cases of 1839-40 were	19·6 „
Dr. Jackson's experience in America gives	22 „
Dr. Jenner's experience in London leads him to give	21 to 30 „
Dr. Murchison	24·6 „

The mean of these varied statements gives nearly twenty-three days.

It is now well known that, during the progress of this form of fever, there is a repetition of the development of new material in the individual gland vesicles of the intestine, and consequently a succession of retrograde metamorphoses; so that, in many extreme cases of *typhoid fever*, it is not unusual to have the malady prolonged throughout a course nearly double as long as that of *typhus*; and that, undoubtedly, the influence of the secondary local lesions of *typhoid fever* is great in protracting the disease. Thus it is that a very indefinite idea of its duration prevails; and, as Dr. Jenner has shown, it is of the greatest importance to know when the original fever ceases, after which we are to consider the subsequent symptoms as due to the effects produced by the local lesions.

As long as fresh eruption continues to appear, the fever cannot be regarded as having terminated; and except in cases of relapse, fresh spots never appear after the thirtieth day (JENNER) or thirty-fifth day (MURCHISON).

True relapses are occasionally observed. They occur about ten days or a fortnight after convalescence from the first attack, and are marked by a return of all the former symptoms; while the

duration of the attack is usually shorter than that of the first; and, according to the experience of Murchison, it is more severe. They are most common in Autumn.

Origin and Propagation of Typhoid Fever.—It is now about thirty years since M. Bretonneau related to the French Academy of Medicine a series of cases in which the communication of this disease from person to person, and its modes of propagation in this way, were so evident as to admit of no reasonable doubt. Nevertheless, the conclusion arrived at has not been generally accepted by the profession, so that the communicability of typhoid fever has not met with general belief. "In so vital a question," writes Dr. Budd, whose views (as I have attempted to put them here) seem especially deserving of attention, "it is, I need scarcely say, of the highest importance that the actual truth should be generally known." And Dr. Watson, whose authority is undisputed, very justly remarks that, "If this fever be really contagious, it is not only erroneous but dangerous to hold the contrary opinion." "To what extent it is dangerous," continues Dr. Budd, "may be best measured by the fact, that in this country alone 20,000 persons die annually of this fever, and 140,000 more are laid prostrate by it." Thus, vast is the field for the operation of preventive measures. And when the discovery and success of such measures must depend in a great degree on our insight into the real mode of propagation, it is at once seen what importance the question assumes. Dr. Budd has, I think, clearly demonstrated the following facts:—1. That typhoid fever shows a decided tendency to spread through a household, a school, a barrack, or a village, when it has been once introduced. The introduction and propagation of the fever in the Clergy Orphan School at St. John's Wood (*Lancet*, 15th Nov., 1856) is an instance in point. The first case was imported, and the illness began ten days after arrival; within three weeks four more cases occurred, and then *nineteen* cases were simultaneously affected within thirty-six hours. The fever which prevailed in the Military School of La Flèche in France, in 1826, is a no less instructive example. The outbreak commenced first with a few scattered cases, and the disorder spreading, the school was broken up earlier than usual, and the pupils sent home. But before this disruption could be carried into effect, sixty of the number were seized with typhoid fever. Twenty-nine others carried the seeds

of the fever with them, and were laid up by it at their own homes. Of these twenty-nine, it was ascertained that *as many as eight communicated the disorder to persons who were engaged in attendance upon them.*

In further illustration of the doctrine of communicability, Dr. Budd cites with minute details numerous examples in the village of "North Tawton," in which typhoid fever having once appeared in a household, it extended itself to one or more members of the family before it finally died away. During the prevalence of the fever in this village, it also so happened that three persons left the place after they had become diseased, and each of the three persons communicated the same disease to one or more of the persons by whom they were surrounded in the new neighbourhood whither they went. While two of these men remained in the village of "North Tawton," they both lodged in a court having a single and a common privy in it, and next door to a house where typhoid fever was. In due course of time and events both took the disease. The third man was a friend who came to see one of the two men already sick. He assisted to raise his sick friend in bed, and while so employed was quite overpowered by the smell from the sick man's body. The sense of this pestilent smell harassed him for days. He felt very unwell from that time; and on the *tenth* day from the date of the event just noticed, he was seized with shivering, followed by the complete expression of an attack of typhoid fever, which was of long duration; and before he became convalescent two of his children were laid up with the same disease, as well as a brother, who lived at some distance, but who repeatedly visited him during his illness. Except in the houses of these men no fever existed in that part of the country. Further most interesting and conclusive examples are given in Dr. Budd's admirable papers published in the *Lancet* of 9th July, 1859, which prove beyond question that typhoid (intestinal) fever is a most readily communicable disease. The facility for propagation, however, seems to be modified under particular circumstances of season, place, and habits of life; in other words, the propagation of the disease requires some special conditions, which may be said of the whole class of communicable diseases.

2. The disease having once occurred, the patient is protected from a second attack. The specific nature of the disease is thus

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THE VIRULENT PART OF THE FEVER—TYPHOID FEVER.
is also established for the fever not only propagates itself, but pro-
poses the other kind of fever—one case following another with
the same constancy of specific type that small-pox follows small-
pox or measles succeeds to measles.

3. There seems also to be a definite period in which the
poison is latent after being communicated—a period of incubation,
during which a definite interval elapses before the development
of the fever begins. This period, according to Dr. Budd's expe-
rience, seems to be from about a week to ten or fourteen days.
*The living human body, therefore, is the soil in which this specific
poison breeds and multiplies; and that most specific of processes
which constitutes the fever itself is the process by which the
multiplication is effected.*

4. Like all other diseases of its kind, its origin is unknown;
and the first case in the series of each of these outbreaks men-
tioned, may either have been casual and imported, or it may
have been due to a rekindling of some dormant germ left from a
former similar attack.

5. The virulent part of the specific poison by which the disease
is communicated is doubtless contained in the diarrhoeal dis-
charges which issue from the diseased and *exanthematous* bowel.
These discharges drying up, the germs of disease are thus pre-
served as effectually as the crusts of small-pox preserve the virus
of that disease. If, therefore, through atmospheric or other
agencies these germs obtain access to the living body, diarrhoea
is brought about in the usual course of events, and the com-
mencement of the disease thus communicated takes place. The
discharges from the bowels of the person so infected, which are
at once copious, numerous, and liquid, are thrown into the
water-closet or the privy, and the drains, or systems of drains,
become at once saturated with the specific poison of the disease in
its most concentrated and virulent form.

Regarding, therefore, the drain or system of drains as a
channel directly continuous with the diseased intestine of the
infected person, the specific virus of typhoid fever may be pro-
pagated amongst healthy persons in one of three ways—namely,
(1.) By percolation through the soil into the wells which supply
drinking water to the inhabitants; (2.) By issuing through
defects in the sewers into the air of the inhabited area; or, (3.)
By exhalation through the aperture of small ill-trapped water-

closets or privies, which are at once the receptacles of the discharges from the sick and the daily resort of the healthy.

When the specific poison thus issues into the air the *atmosphere generated is immeasurably* more likely to communicate the disease than that which immediately surrounds the fever patients. "There is reason to believe, however, that the duration of the period of incubation varies considerably, partly with the nature of the medium through which the specific poison finds admission to the living body, partly by reason of the conditions it meets with there, and still more so *in virtue of the greater or less intensity of the state of change* in which the poison itself may be at the moment of its reception." Hence the simultaneous seizure of a large number of persons within a definite interval after the occurrence of a single case, points to some one or other of these modes of propagation. Such modes of propagation are thus the exact counterpart of what has been oftentimes observed (especially in schools) in the case of measles, scarlet fever, and in former times, of small-pox also (DR. W. BUDD).

Preventive Measures, or Measures for Checking the Spread of Typhoid Fever.—The measures about to be specified have been made public through the writings of Dr. William Budd on this subject; and, *provided they are thoroughly and efficiently carried out*, it is believed that the recurrence of typhoid fever may be entirely prevented.

To enable us to judge of the extent of the infection to be destroyed, there are two elements to be taken into account,—*First*, The amount and duration of the intestinal discharge in each case; and, *Second*, The number of cases actually occurring. With regard to the first, Louis has found that the average duration of the alvine flux in cases of typhoid fever is *fifteen* days in mild cases and *twenty-six* days in severe cases. With regard to the second point—namely, the number of cases occurring—the Reports of the Registrar-General show that at least 100,000 to 150,000 cases of typhoid fever occur annually in England alone. In other words, "*every year in England more than 100,000 human intestines, diseased in the way already described, continue each, for the space of a fortnight or thereabouts, to discharge upon the ground floods of liquid charged with matters on which the specific poison of a communicable disease has set its most specific mark* (BUDD).

The measures recommended for preventing the spread of this fever are founded on the power of chemical agents to destroy absolutely the material which contains or carries the specific virus of such communicable diseases. Assuming it, therefore, to be certain that the intestinal discharges in typhoid fever are the media of propagating the disease, it is no less certain that by SUBJECTING THE DISCHARGES ON THEIR ISSUE FROM THE BODY TO THE ACTION OF POWERFUL DECOMPOSING CHEMICAL AGENTS, THEY MAY BE ENTIRELY DESTROYED OR DEPRIVED OF THEIR SPECIFIC VIRUS. He suggests the following details of procedure:—

1. All discharges from the fever patient should be received on their issue from the body into vessels containing a concentrated solution of chloride of zinc.

2. Two ounces of a caustic solution of chloride of zinc should be put in the night-stool on each occasion before it is used by the fever patient.

3. All tainted bed or body linen should, immediately on its removal, be placed in water strongly impregnated with the same agent.

4. The water-closet should be flooded several times a-day with a strong solution of chloride of zinc; and some chloride of lime should be also placed there to serve as a source of chlorine in the gaseous form.

5. So long as fever lasts the water-closet should be used exclusively as a receptacle for the discharges from the sick.

The Privy Council have now made the principle of this method an integral part of their "general memorandum on proceedings advisable to be taken in places attacked or threatened by epidemic disease," and which is given *in extenso* at page 220 of this volume.

Vague and untenable notions have been gathering round this subject, particularly in relation to the propagation of typhoid fever; and if once a disease of this kind is decidedly proved to be the result of a specific poison, and to be propagated in the way just described, "we cannot help entertaining a doubt," says Dr. Watson, "whether the disorder in question really ever has any other cause." Nevertheless, other causes are assigned to typhoid fever; which by some is even looked upon as a disease developed out of external conditions alone. In reasoning on the subject, it must be remembered at the outset that the dissemination of

typhoid fever by a *specific poison* implies precisely what it implies in small-pox; and that it is provided for in the same way—namely, by the multiplication of a *specific poison* in the living but diseased body. Each of these specific poisons (and, as we have already seen, they are numerous) thus multiply in the same way and in the same remarkable medium, out of the same living organisms of the human frame; yet each of these several poisons sets up a series of changes which always issues in the reproduction of its own specific kind of disease, and no other. Small-pox gives rise to small-pox, scarlet fever to scarlet fever, measles to measles, and so on. Herein lies their *specificity*. Such being the doctrine attempted to be maintained in these pages, the theory of the spontaneous origin of typhoid fever, or of any other specific disease, must be in the same relative position as when it seeks to explain by such a principle the propagation of plants and animals. These—namely, plants and animals—likewise at least two diseases—namely, *syphilis* and *small-pox*—are certainly now known to propagate only by the law of continuous succession, whatever may have been their primary source. But the hypothesis of spontaneous origin and indefinite propagation of typhoid fever has assumed a definite form of expression in the doctrine which attempts to teach that typhoid fever is often actually caused by the products of common putrefaction—a doctrine which has been cleverly embodied in the nomenclature of the subject by Dr. Murchison, and thus a degree of precision and permanence has been given to the opinions he has so ably advocated in a volume on the *Continued Fevers of Great Britain*—a volume which is unsurpassed for its erudition and its practical importance.

The term “pythogenetic fever,” or fever “born of putrescence,” is the name by which Dr. Murchison at once designates typhoid fever and theoretically implies its origin. He has thus rashly committed Science to an hypothesis of a highly doubtful nature. Without, however, doubting the fact, that animal and vegetable substances in some states of decomposition have the power of inducing ill-health; and that there is now acknowledged to be a connection between putrid states of the air and the prevalence of pyæmia, erysipelas, puerperal fever, and cholera; yet there does not seem to be sufficient evidence to show that any of these causes can *produce* a disease which is of so specific a nature as to

be maintained and propagated by a specific poison generated in the body alone. Undoubtedly, the state of ill-health induced by the decomposing material of night-soil and the like, does produce *a state of the system favourable to the development*, not alone of typhoid fever, but of many other specific diseases, such as cholera, dysentery, yellow fever, and the like. This predisposition to such diseases seems to be exactly analogous to the preparation of a soil for seed. Dr. Carpenter, also, long ago showed physiologically what observation has since confirmed—namely, that decaying animal material, especially night-soil, seems to be for some poisons (*e. g.*, cholera and yellow fever) great centres or foci, where the specific germs or poisons are able to multiply; and for the propagation of which “foulness of medium is indispensable.” An interesting question for inquiry is thus opened up as to whether the germs of typhoid fever, cholera, and the like, could be made experimentally to grow or increase upon or about organic matter, just as the germs or spores of many fungi are induced to grow in collections of manure (DR. LANKESTER). In such collections on the earth’s surface there is reason to believe that germs of diseases, like cholera, and typhoid fever, and yellow fever, may find a resting-place—that thus they are always extant somewhere—although it may be only now and then, when season and other conditions conspire, that they display their full power as epidemic diseases. As such, they seem to occur every now and then as “mysterious cycles,” the existence of which we admit, but do not understand.

The history of typhoid fever, whose leading features have been thus described, is wholly inexplicable upon the “pythogenetic theory” of Dr. Murchison. On the contrary, it is emphatically the history of a specific disease generating a specific poison, and propagating itself by it:—

“*Mutatis mutandis*,” writes Dr. Budd, “it is the history of *small-pox*, it is the history of *scarlet fever*, it is the history of malignant cholera. In all these specific contagions we meet with these same alternations of slumber and activity; of wide-spread prevalence in one place, while other places hard by remain free; and finally, with the same successive invasion of neighbouring places, in such wise that the reigning disorder—be it small-pox, measles, scarlet fever, intestinal fever, or malignant cholera—often only begins to prevail in the new locality when it has already died out in the old.

"It is, in fact, in a general survey of this kind that we get the clearest view of the thread which really connects all these circumstances. There is plainly but one thing constant; that is to say, a specific morbid cause—a cause which is neither a permanent product of the soil, or air, or of particular seasons, but which is susceptible of transmission from place to place; which breeds as it goes, and then again dies out or becomes dormant, without leaving any sign to mark its track.

"There is only one thing of which these can be the characteristics; and that is the specific poison which is bred of the disease, and by which the disease propagates, and which, in common with the other specific poisons perpetuated by the same law, possesses all these properties.

"Thus, when we come to scrutinize closely this course of the fever, even in these broad relations, we are again brought to recognize that which we have already proved by direct evidence—namely, its essentially contagious nature. This is the master fact in its history; the fact which governs all the rest."

But whatever may be the view theoretically adopted regarding either the origin or the propagation of typhoid fever, it is satisfactory to know that practically medical officers can employ preventive measures which, to use the words of Dr. Lankester, "will cover the issues of both theories." These measures have been minutely described, and if they are universally carried into effect, it is not too much to expect that this fever might soon become perhaps extinct. At all events, with the facts before us, it is unwarrantable to permit the great bulk of what escapes from the diseased intestine of typhoid fever patients to be let loose upon society, into the cess-pool or sewer, or on the dung-heaps, in full possession of all their deadly power, without being first destroyed in the way that has been recommended.

"The grand fact is clear," writes Dr. Parkes, "that the occurrence of typhoid fever points unequivocally to defective removal of excreta, and that it is a disease altogether and easily preventible." Typhoid fever ought therefore soon to disappear from every return of disease, whether in military or in civil life.

Treatment of Enteric or Typhoid Fever.—The chief indications of treatment are to reduce temperature and subdue vascular excitement if these be in excess, to restrain the diarrhoea, to stimulate the nervous system when necessary, to obtain a free action of the kidneys, and to influence the elimination of growth from the intestinal glands.

To accomplish the first of these indications the use of *digitalis*

has been especially recommended by Wunderlich. He considers that it decidedly mitigates the febrile symptoms which are present in severe cases at the time when the ulcers begin to heal, and which often impede or prevent recovery. He advocates its use in the severe forms of the fever only, especially at a time when most danger is to be apprehended from the violence of the fever in the second week, when the evening temperature is at its highest (105° to 108° Fahr.), and when the remissions in the morning are slight; when the pulse is frequent, 110 to 120 or more. In mild cases it is superfluous. He finds that in the form of *infusion* it is easily absorbed by the intestines of patients suffering from fever; and if given in a suitable dose, has most marked effects in subduing the rate of pulsation and in reducing animal heat. Large doses of the infusion should be given without interruption until the full effect has been obtained,—

An infusion of fifteen or twenty grains of digitalis may be consumed in twenty-four hours by adults.

It acts more rapidly on animal temperature than on the heart. For the first few days after its use the decrease of temperature is rather slight, but may afterwards become considerable, and after it has been much diminished and again rises, it never attains its former excessive height. The full effects of the medicine are known to be brought about if the temperature is reduced to 2° or 3° Fahr. in the evening; and the action of the remedy does not continue beyond one day after its use has been discontinued. The diminution of the pulse is slight at first, and occurs in some cases on the second day after the remedy, but mostly on the third day, or even later; and on the fourth or fifth day after the medicine has been commenced the rate of pulsation may be diminished by thirty to forty or fifty beats within from twelve to thirty-six hours. The pulse may continue to fall even below its normal velocity, and this reduction of pulsation may last for several weeks in succession.

If the velocity of the pulse should decrease rapidly, the use of the digitalis must be discontinued at once. (*Archiv der Heilk*, 1862, p. 116.)

Cold and tepid sponging, or the cold affusion, are remedies which Dr. Murchison considers deserving of further trial for reducing the pulse and temperature. To restrain excessive diarrhœa,

lime water mixed with milk in equal parts, and taken as a drink, is found to be beneficial, agreeable, refreshing, and nourishing. It is not clear that the diarrhœa *ought* to be checked. On the contrary, Professor Gairdner, of Glasgow, is in favour of the French practice of giving saline laxatives, rather than astringents; also of the diligent use of enemata to unload the bowels from below, where anything like abdominal distension has occurred. These enemata may be simply of warm water, to which a little aniseed is added; or, the asafœtida enema may be given.

Dr. Huss, of Stockholm, is of opinion that the diarrhœa during the first stage ought not to be arrested, but abated and mitigated if excessive. If it is suddenly arrested, meteorism is produced, and pains in the intestines; or, vomiting may supervene, with cerebral symptoms, and the febrile phenomena are increased. The diarrhœa is too copious if the evacuations exceed four or five a-day, being of considerable quantity and fluid. Such evacuations weaken the patient rapidly, and should be mitigated by mucilaginous drinks, such as rice water, infusion of lintseed, decoction of *althœa officinalis*, or ipecacuanha in small and repeated doses. This latter remedy seems to retard the peristaltic action of the intestines, and to lessen the secretion from the mucous membrane. The dose must be regulated so as to avoid vomiting; and the feeling of nausea which is apt to follow the first dose, soon disappears with continued use. Dr. Murchison agrees with the late Dr. Todd, who writes as follows:—"Restrain diarrhœa and hæmorrhage in typhoid fever, and when you have fairly locked up the bowels, keep them so. Patients will go for four or six days, or even longer, without suffering inconvenience from this state of constipation." Dr. Huss and Dr. Murchison speak highly of the benefits to be derived from the mineral acids—hydrochloric and sulphuric especially. From fifteen to thirty minims of the dilute acids may be given every three or four hours; and with each dose Dr. Murchison recommends half a grain of quinine, as in the following prescription for an adult:—

R. Acid, sulph., dil.; vel. acid, hydrochlor., dil. M., xx. ad xxx.

Quinæ disulph., gr. $\frac{1}{4}$, ad gr. $\frac{1}{2}$.

Syrup, aurantii, ʒss.

Aquæ carui, ad ʒi Fiat haustus, ʒâ, vel. 4â, horâ sumendus.

(MURCHISON).

He is of opinion that if there be more than two motions in the twenty-four hours, with marked prostration, that astringents should be had recourse to. A starch enema, containing from ten to twenty drops of laudanum, should be administered towards evening, and recourse may also be had to the following draught:—

R. Acid, sulph., aromat,	. . . . .	M. xxx.
Liq. opii. sedativ,	. . . . .	M. iiii.
Aq. menth. pip.,	. . . . .	ʒi. nd.
Fiat haustus, 4tâ, vel. 6ta, quaque horâ sumendus (MURCHISON).		

If the mineral acids are not tolerated by the stomach, acetate of lead is worthy of trial, in doses of two or three grains in solution every four or six hours, with or without an eighth of a grain of acetate of morphia (MURCHISON).

Alum dissolved in gum, to the amount of twenty-four grains in a day, which may be increased to one drachm, is best given in the form of *alum whey*, prepared by adding one drachm of alum to a pint of boiling milk, and then straining. Two ounces may be given after each motion of the bowels (FOUQUIER, MURCHISON).

A seidlitz powder may sometimes check the diarrhoea, by altering the secretions, and is especially beneficial if there be much meteorism (TROUSSEAU, MURCHISON).

Nitrate of silver in doses of one to three grains, made into a pill, and taken every six or eight hours; or sulphate of copper in doses of a quarter of a grain similarly given, are remedies most useful in the diarrhoea connected with atonic ulcers, after the fourth week of the disease (BELL, MURCHISON).

If meteorism or tympanitis prevail from the accumulation of air in the colon, it may sometimes be relieved by the passage of a long stomach-pump tube by the anus, as far up the colon as it can be made to go easily.

With regard to stimulation of the nervous system, it is not decided how far alcohol is beneficial. The fever eventually is attended with much exhaustion, and is often protracted, yet typhoid fever does not seem to bear stimulation so well as typhus. The tendency to prostration is the only indication for its use; but its use must not be persevered in if the pulse is quickened, the hectic flush made more manifest, the tongue made drier, or if delirium supervene after its use. Food and sustenance are the real preventives of delirium, and the best

stimulants to the nervous system when necessary. With regard to the maintenance of free action from the kidneys, it is to be observed that so long as the *excretion* of urea and uric acid is abundant, no diuretics are necessary; but whenever the amount of the solids falls greatly (which can be known at once with sufficient accuracy by a comparison of the urine passed in twenty-four hours with the specific gravity), means must be taken at once to increase, if possible, the urinary elimination. The *warm bath*, with repeated small doses of the *alkaline carbonates*, or of the *nitrate* or *bitartrate of potash*, will often effect this (PARKES, l. c.).

To accomplish the last indication—namely, to influence the elimination from the intestinal glands, by direct local action on the intestinal membrane—Wunderlich especially advocates the use of *calomel*, if it can be given before the ninth or tenth day. Dr. Parkes is also of opinion that it is extremely useful at this period. The late Dr. Anthony Todd Thomson used to give it; and, from the observation of many cases under the care of this physician, as well as from his own experience, Dr. Parkes considers that *calomel* is a medicine to be strongly recommended in typhoid fever. But it must not be given later than the tenth or eleventh day; and at no time in large doses.

One or two grains twice a-day is enough, although Wunderlich gives one to five grains twice daily; but five grains is considered by Dr. Parkes to be too large a dose.

Dr. Wood, of Philadelphia, bears testimony also to the benefit to be derived from mercury about the seventh or ninth day of the fever. He believes "it tends in some degree to arrest the progress of the disease in the glands of Peyer, and to promote resolution of the inflamed patches. He prefers minute doses of the blue pill mass—a grain every two hours—till the mouth is slightly affected, associated with small doses of *ipecacuanha*, when the stomach is not irritable. The beneficial effect of this combination is shown by the tongue becoming moist, the skin relaxed, and the symptoms generally being ameliorated. Dr. Wood recommends twelve grains of *blue pill mass* to be combined with two grains of *ipecacuanha powder*, with two grains of *opium powder*; and the whole being divided into twelve pills, one may be taken every hour, or every hour and a half, or every two hours. (*Practice of Medicine*, vol. i., p. 345, 4th edition.)

He is of opinion that
twenty-four
should be
to twenty
evening.

It is also not proper to be given if the diarrhoea is excessive pains in the bowels, with very anæmic, or if there is a hæmorrhagic diathesis. It is also not proper to be given if the first dose is vomited, the Calomel has no direct effect on the pulsation or respiration, nor on the cerebral functions; but its beneficial influence is very decidedly appreciable by the modifications of temperature which it induces, and which have been already noticed at page 389.

No general rules can be laid down to guide the treatment of the intercurrent phenomena or accidents of the disease.

Abdominal pains and meteorism may be relieved by mustard poultices, or turpentine *stupes* may be applied, followed by simple hot water fomentations. After these remedies have been applied, cold water compresses over the abdomen tend to lessen the tension and the gurgling in the intestines, and to diminish the tenderness on pressure. They counteract the inclination to meteorism, and lessen the diarrhoea. Dr. Huss believes also that the ulcerations in the ileum are prevented from spreading; and that perforations of the intestine have been of much rarer occurrence since he commenced to use these compresses. The compress, after being soaked in warm, but not hot water, is well wrung, and applied so as to cover the whole abdomen; and it must be changed two or three times a-day, according to its tendency to dry. The compress is composed of four to eight double folds of coarse linen, and is to be laid over the whole abdomen, and afterwards overlaid with a cover of oiled skin or india rubber stuff, to prevent too rapid evaporation. The compress should fit as closely as possible, and care must be taken that it is not displaced, otherwise air enters between the skin and the compress, so that cold, instead of a moist heat, is produced. These compresses may remain untouched as long as they are moist and warm; and they may be employed on the chest as well as on the abdomen, should capillary catarrh or pneumonia supervene.

Hæmorrhage from the bowels, partly fluid and partly in clots, evacuated with the stools, is a symptom of grave import; and the urgent aim of treatment is to arrest the bleeding. Huss found the *sugar of lead* most serviceable, administered by the mouth, and also by clysters. By the mouth two grains may be given

every half-hour, and even every quarter of an hour; and it is best given dissolved.

Twenty-four grains of *crystallized acetate of lead* being dissolved in one dram of *dilute acetic acid*, to which six ounces of *distilled water* is added, a table-spoonful of this solution may be given every half-hour. At the same time a clyster may be administered composed as follows:—Ten to fifteen grains of *acetate of lead* are to be dissolved in four ounces of *distilled water* (warm), to which twenty or thirty drops of tincture of opium may be added; and the administration of such a clyster may be repeated in four or six hours if required. Pieces of ice may also be swallowed now and then; and even crushed ice may be applied, enclosed in a bladder, over the abdomen.

If bleeding from the nose is not arrested by the use of vinegar and cold water injected up the nostrils, nor by the use of cold water compresses applied to the nose, plugging by the posterior nares must be had recourse to.

Turpentine is also a most valuable remedy in hæmorrhages, and in the stage of ulceration. It was originally recommended by Dr. Graves, and is highly spoken of by Drs. Huss, Wood, and Murchison. It may be given in all cases where the tongue is dry; and when, "instead of cleaning gradually from the edges and tip, it often parts with its fur quickly and in large flakes; generally, first, from the middle or back part of the surface, which is smooth and glossy, as if deprived of its papillæ. There is also generally an increase of the tympanitis, and the ulceration of the ileum seems to be attended with great dryness of the tongue." Under these circumstances Dr. Wood gives the oil of turpentine in doses of five to twenty drops every hour, or every two hours. It is best administered in an emulsion with gum arabic, loaf sugar, water (WOOD), or in an emulsion with the yolk of an egg and honey or mucilage (HUSS). Amelioration of the symptoms may be observed in twenty-four or forty-eight hours—the tongue becoming more moist, and covered with a white fur—distension of the abdomen ceases to progress, and after a time diminishes. The use of the oil should be continued under these circumstances; but the dose should be gradually diminished.

Tonics and stimulants may be absolutely essential on account of debility attending the advanced stage of the disease, generally about the third week. When the pulse is slow and feeble, the

skin cool, the tongue and teeth encrusted with dark sordes, at an advanced period of the fever, then stimulants are obviously necessary. But even when the pulse is feeble, but yet frequent, and the skin hot, stimulants are even then known to be of service; but it is necessary to administer them with great caution, and to watch the effects constantly and closely. If their use is found to augment the heat of the skin, and to increase the frequency of the pulse, and to aggravate the delirium or stupor, it is then necessary to suspend their use. They are known to be doing good service, however, if they lessen the frequency of the pulse and increase its fullness and strength, if the skin becomes cool and moist, and if the delirium is subdued or moderated, and especially if refreshing sleep be procured. Dr. Wood recommends the use of wine whey, prepared by adding *one quart of good sherry wine* to *two quarts of boiling milk*, and straining after coagulation.

Of this a table-spoonful or more may be given every hour or every two hours. If the strength is greatly reduced, it may be necessary to give pure wine or brandy; or even sulphuric or chloric ether in cases of great prostration. Opium is also a useful stimulant. It may be given when the pulse is not full nor strong, and when cerebral symptoms do not exist. In the later stages it may be given in doses of half a grain, or a grain, every four, six, or eight hours. It is known to be acting beneficially when it promotes sleep, subdues nervous excitement, and induces gentle perspiration. Carbonate of ammonia is objectionable, as it may irritate the bowels and increase the diarrhoea.

The diet is of the utmost importance to be attended to in cases of typhoid fever from the very commencement of the disease. It ought then to be both food and drink combined, in the form of a light nutritious liquid. Barley water, rice water, toast and water, thickened more or less with solutions of tapioca, sago, arrow root, *the juice* of sweet fruits, or the very soft pulp of fruits, or the pure jelly of ripe fruits; but fruit in its crude state is to be strictly withheld. It is necessary, as a rule, to give food at certain intervals and in certain quantities. The bulk of a wine-glassful should be given at least every two or three hours, according to the state of digestion and the demands upon the strength of the patient. It may be that the patient is unable to swallow, from the dry and shrivelled state of his tongue. Before

offering him food or drink, therefore, the nurse should put a tea-spoonful of lemon juice and water into his mouth. She must then wait a minute or so, until the fur upon the tongue and mouth is softened and moist, after which the patient will often drink or take his food with ease. Milk in small quantities frequently repeated will also be found an excellent diet; and animal broths and jellies may ultimately be given.

The utmost caution is necessary as to diet and aperients during convalescence; *first*, as to opening the bowels, castor oil or simple enemata are the only means which should be resorted to; *secondly*, as to diet, no flesh meat should be allowed till at least seven days after all the febrile phenomena have passed away, and the food should be as free as possible of excrementitious matter; and malt liquors should not be taken *before* food.

TYPHUS* FEVER—*Febris Typhus*.

Definition.—*A continued fever, attended with sluggishness of intellect and confusion of thought, followed and accompanied by an eruption on the skin, of a rubeoloid appearance, appearing generally from the fifth to the eighth day, at first slightly elevated, and disappearing on pressure, but after the second day persistent, and remaining persistent for eleven or twelve days. Langor and weariness, prominent from the first, gradually pass into stupidity, oblivion, and complete prostration; which, in still more extreme cases, pass into somnolence, stupor, and sometimes coma, when prostration becomes profound. The disease may*

* As the term typhus is very variously used, and sometimes vaguely, it is necessary to state precisely the meaning of the word. This cannot be more clearly, distinctly, and concisely expressed, than in the words of Dr. Wood.

The disease now defined is sometimes called *typhus*, and sometimes *typhus fever*. In the first instance the term is used "substantively, in the latter adjectively, just as we say ship fever, jail fever, &c. But a state of system, identical or closely analogous with that which characterizes *typhus* fever, is frequently met with in other febrile diseases, as a mere incidental accompaniment. To this morbid state the epithet *typhous* or *typhoid* is applied, the latter being preferred to the former when it is wished to imply resemblance only, and not sameness or identity. Thus we speak of a *typhous* or a *typhoid* condition of remittent fever, yellow fever, small-pox, measles, pneumonia, dysentery, or with greater brevity *typhous pneumonia*, *typhous dysentery*. This latter phraseology, however, generally implies a more thorough incorporation of the *typhoid element* with the principal affection, than *typhoid pneumonia* or *typhoid dysentery*, which merely implies a resemblance to the *typhous* state occurring in these diseases."

terminate favourably from the thirteenth to the seventeenth day, the average duration of the attack being about twenty-one days. If the disease proves fatal, it is generally between the twelfth and the twentieth day, leaving no specific lesion beyond hypercæmia, softening of the heart and contractile fibre structures, and atrophy of the brain.

Historical Notice.—The first authentic accounts of typhus fever are to be found in the early British chronicles. It is described as having spread in our courts of justice, giving rise to what was termed “the black assizes.” The last black assizes happened at the sessions of the Old Bailey in 1756, when the lord mayor, two of the judges, and several eminent persons died, infected by the prisoners. This fever has had many popular appellations, having been known as the *jail fever*, *hospital fever*, *ship fever*, *putrid fever*, *brain fever*, *bilious fever*, *spotted fever*, *petechial fever*, *camp fever*. We are indebted, however, to Pringle and to Fordyce for having shown that these supposed different fevers are identically the same, and have no such essential differences as to constitute them distinct genera.

Typhus fever is the grand scourge of armies in temperate climates, just as cholera and yellow fever have been the destructive agents in the tropical wars. (Parkes “On the Causes of Sickness in English Wars,” *Journal of Royal United Service Institution*, vol. vi.) Wherever men are closely crowded together in ill-ventilated unwholesome dwellings typhus is sure to appear. It has often passed from the army to the civil population, and has thus dispeopled towns and even great districts of country. But its ravages in the English army have never been comparable to those which have occurred in foreign forces, as the statements of Murchison and Parkes fully demonstrate:—“In the year 1489 no fewer than 17,000 of the troops of Ferdinand, then besieging Granada, were destroyed by a spotted fever, to which the Spaniards applied the same name that they afterwards gave to typhus. In 1552 a petechial fever devastated the army of the Emperor Charles V., during the siege of Metz. In 1556 the notorious ‘*Morbus Hungaricus*’ appeared in Hungary in the army of Maximilian II., and thence spread over the whole of Europe” (MURCHISON, l. c., p. 21.) “In 1620 the Bavarian army in a few months lost in Bohemia not less than 20,000 men from spotted typhus, and the disease being carried into other parts of Germany, obtained

the name of 'the Bohemian disease.' In 1628 and 1632 the Swedish army under Gustavus Adolphus carried typhus into Northern Germany, and the population was so destroyed that, fifty or sixty years later, villages were left without inhabitants (PARKES, l. c.). In the spring of 1643, while the Earl of Essex was besieging the town of Reading, this disease broke out in the army of the Parliamentary General, and also in the garrison commanded by Charles I.; it was communicated to the inhabitants of the surrounding country, and proved very fatal (MURCHISON, l. c.). The wars of Louis XIV. were always followed by this disease, and the losses of the French army were enormous (PARKES). In 1799-1800 an epidemic of typhus occurred at Genoa, when the garrison was besieged by the French and half famished; and the French army, during their retreat from Italy, communicated fever to the inhabitants of fifteen towns and villages where they halted on the route (FODERE). It was during the first fifteen years of the present century that the greatest ravages of typhus have been recorded, especially in the armies of Napoleon, and among the population of the countries which were the seat of war. It always arose under circumstances of misery and privation, and was particularly prevalent and fatal among the inhabitants of besieged cities, as, for example, Saragossa and Torgau, Dantzic and Wilna, in 1803, and which told with such awful severity upon the famished French troops during the retreat from Moscow in 1812 and 1813 (MURCHISON). In May, 1812, the Bavarian army serving among the French numbered 28,000 men; in February, 1813, there were only 2,250 men under arms. The great destroyer was typhus. In August, 1813, the first Prussian army consisted of 37,728 fighting men, having lost 16,000 men by the sword, and 10,000 men by disease, almost entirely typhus. In Mayence alone, of 60,000 French troops composing the garrison in 1813-14, there died of typhus in six months 25,000 men (MURCHISON, p. 224). The last great ravages of typhus in armies which attracted public attention were those which occurred in the French and Russian armies in the Crimea during and after the capture of Sebastopol. Typhus had prevailed in the winter of 1854-5 amongst both the English and French troops; but in the following winter it was mainly confined to the French and Russian armies. In the spring of 1856 it was computed that

more than 17,000 men of the French forces perished in less than three months; and the highest authority stated that the safety of the whole French army was endangered by the outbreak (PARKES and MURCHISON).

According to Dr. Parkes, typhus fever occupies the fourth place among the causes which have produced disease in the British army.*

Phenomena and Symptoms.—Typhus fever attacks persons of both sexes and of all ages, from early infancy to extreme old age, and its advent is somewhat sudden.

After a longer or shorter duration (generally a few days) of unpleasant sensations—in which general soreness, uneasiness, and fatigue without cause, loss of appetite, and disturbed sleep, are the prominent phenomena—the disease begins and advances gradually. It is not possible in all instances to fix the precise time of the commencement of the attack; but in the majority of cases the patient is seized with chilliness, which sometimes amounts to a rigor, usually followed by heat of skin, and occasionally by sweating, pains in the back and limbs, and frontal headache. This headache is a constant symptom, which ceases usually about the tenth day, and always before the fourteenth. During two or three days the chilliness and rigors occur at irregular intervals. The patient alternately hovers over the fire, or desires to move

* These causes Dr. Parkes arranges as follows:—

1. A defective commissariat, especially as to food and fresh vegetables, causing diseases, but mainly predisposing to many more—*e. g.*, malignant malarious fevers, scurvy, and bloody flux. Carthagera, 1741; Burmah, 1824; China, 1840.

2. Undertaking military operations in an unhealthy site, and with an unhealthy season impending. Carthagera, 1741; San Domingo, 1796; Walchern, 1747; Java, 1811; American War, 1814; Bulgaria, 1853-4.

3. Exposure to cold, with insufficient clothing and food, giving rise to catarrhs, slight dysentery, rheumatism, and inflammations. Wars of 1742-1760; Crimea, 1854.

4. Propagation of typhus poison, favoured by bad ventilation, overcrowding, and filth. Examples as above detailed.

5. Similar propagation of putrid dysentery. Indian Campaigns.

6. Propagation of typhoid fever poison and cholera, through the bad sanitary condition of camps, and the occupation of old camping grounds. Egypt, 1801; Bulgaria, 1853; India.

7. The enlistment of boys as soldiers, whose bones are not yet matured—in place of full-grown men at least twenty-one years of age. Crimea, 1854. [See a short publication *On the Growth of the Recruit and Young Soldier*, by William Aitken, M.D.]

8. Want of cleanliness, excessive use of spirits, and debauchery.

from it; and although the skin at the time may be felt hot and burning, he still lingers near the fire-place, and yet again soon complains of the heat of the room; so that he feels when near the fire hot and oppressed, and when away from it chilly and uncomfortable. Loss of appetite, and more or less thirst, exist from the first; the tongue is white, large, and pale, but is afterwards covered with a yellow-brown fur, and is sometimes tremulous, indicating the early loss of muscular power and control. The bowels may be confined or regular; the urine is scanty and high-coloured; and nausea with vomiting are often among the earliest symptoms. If sleep is obtained, it is disturbed by dreams, or by the occurrence every few minutes of sudden starts. It is consequently unrefreshing; and although the patient may have appeared to sleep for hours, yet he feels that he has not slept, and declares that he has never closed his eyes. This is the coma-vigil of Chomel. On the other hand, there is sometimes a constant tendency to heaviness and drowsiness. The attention cannot be fixed, and the mind ceases to think. A peculiar symptom may now become expressed, to which Dr. Jenner has given the name of *coma-vigil*, more appropriately than to that symptom which Chomel has so named. In the coma-vigil of Jenner "the patient lies with his eyes open, evidently awake, but indifferent or insensible to all going on around him." This symptom occurred in one-fifth of the fatal cases observed by him. Bodily weakness becomes extreme, and the patient takes to bed by the second or third, and not unfrequently on the first day. While there is absolute loss of muscular power and control, there is at the same time an amount of great exhaustion disproportionate by its severity to the muscular action. Giddiness and noise in the ears are amongst the earliest and most loudly complained of symptoms. The debility increases rapidly, so that by the seventh day the patient can rarely leave his bed without some assistance. By this time also the want of control over the muscular movements becomes more decided; the legs and arms shake when raised, and the tongue trembles when protruded. The impairment of the mental powers manifests itself in a variety of singular ways. Memory becomes deficient, the ideas of time are such that it is always supposed to be prolonged. If an event is impressed upon the patient's mind, he will remember it, and it alone. This mazy state of the intellect soon passes into delirium, which becomes

manifest first between waking and sleeping, then by night, and finally by day and night. When delirium first sets in, the patient is able to correct himself; if he is made to think, he becomes conscious of his mental error, but this power is soon lost, and delirium becomes predominant.

About the tenth day of the disease the headache ceases, if it has not already done so, simultaneously with the commencement of the delirium; and if it should continue with the delirium, it suggests the probability of some commencing secondary lesion within the cranium, to which special attention must be immediately directed.

The Eruption of Typhus Fever.—About the fifth to the seventh day of the disease the characteristic eruption appears on the skin. It consists of,—(1.) Distinct spots; (2.) A subcuticular rash.

(1.) The *maculae*, *mulberry*, or *rubeoloid rash*. On the first appearance of this eruption it consists of very slightly elevated spots of a dusky pinkish-red colour, somewhat like the stains of mulberry juice. Each spot is flattened on the surface, irregular in outline, with no well-defined margin, and fading insensibly into the hue of the surrounding skin. The spots *disappear* completely on pressure, resuming their distinctive appearances as the pressure of the finger is withdrawn; and they vary in size from a point to three or four lines in diameter. The largest spots appear to be formed by the coalescence of two or more smaller ones; and the shape of the larger spots is more irregular than the smaller ones. After one, two, or three days these spots undergo a marked change. They no longer remain elevated above the surrounding cuticle. Their hue becomes darker and more dingy than at their first appearance. Their margins become more defined, especially on the posterior surface of the body, and when the finger is firmly pressed on them they grow paler, but do not entirely disappear. Thus they are said “to fade under pressure,” but they cannot be entirely obliterated, a stain of the cuticle remaining to indicate where they are. A still further change may take place in severe cases. The centres of the spots may become dark purple, unaltered in appearance by the firmest pressure, although their circumferences may fade; or the entire spot may change into a true petechia, becoming of a dusky crimson or purple colour, quite unaffected by pressure, with a well-defined margin, and level with the sur-

face. The spots of such an eruption are generally very numerous, close together, and occasionally almost covering the skin. Sometimes, however, they are very few in number, and situated at some distance from each other; and not to be distinguished at first from the *rose spot* eruption. The *mulberry eruption* usually occupies the trunk and extremities, but is occasionally limited to the trunk, and may now and then be observed to extend to the face. After the first, second, or third day after the eruption is apparent, no fresh spots appear, and each spot remains visible from its first eruption till the whole rash vanishes—that is, till the termination of the disease. When very numerous, the eruption, viewed as a whole, has not an equal depth of colour. Some places are much paler than others, and the spots have a dull appearance, as if seen through the cuticle. A mottled aspect is thus sometimes given to the skin, on which the darker spots are seated; and hence (2.) A *subcuticular rash* has been also described, which is deepest coloured on the most depending parts of the body. From this circumstance the eruption sometimes resembles *measles* so closely as to be distinguished with difficulty from the eruption in that disease. When the spots on the back are of a much deeper hue than those on the anterior surface of the trunk, the skin is at the same time so much congested at the back that slight pressure with the finger leaves a white mark, which slowly returns to its dusky red colour. The eruption of the mulberry rash usually appears from the fifth to the eighth day of this disease, and subsides between the fourteenth and twenty-first days (DR. JENNER).

Age seems to exert a considerable influence over the eruption, and the following rule has been laid down in relation to this modifying circumstance:—In 100 typhus patients under fifteen years of age the rash will be absent in 25. In 100 typhus patients between fifteen and twenty-two years of age the rash will be absent in 14. In 100 typhus patients above twenty-two years of age the rash will be always present.

The spots of typhus fever continue ineffaceably persistent after death.

At the termination of the first, or commencement of the second week, the tongue has a large and swollen appearance, grows dry in the centre, and at the same time its white fur is replaced by pale dirty brown mucus.

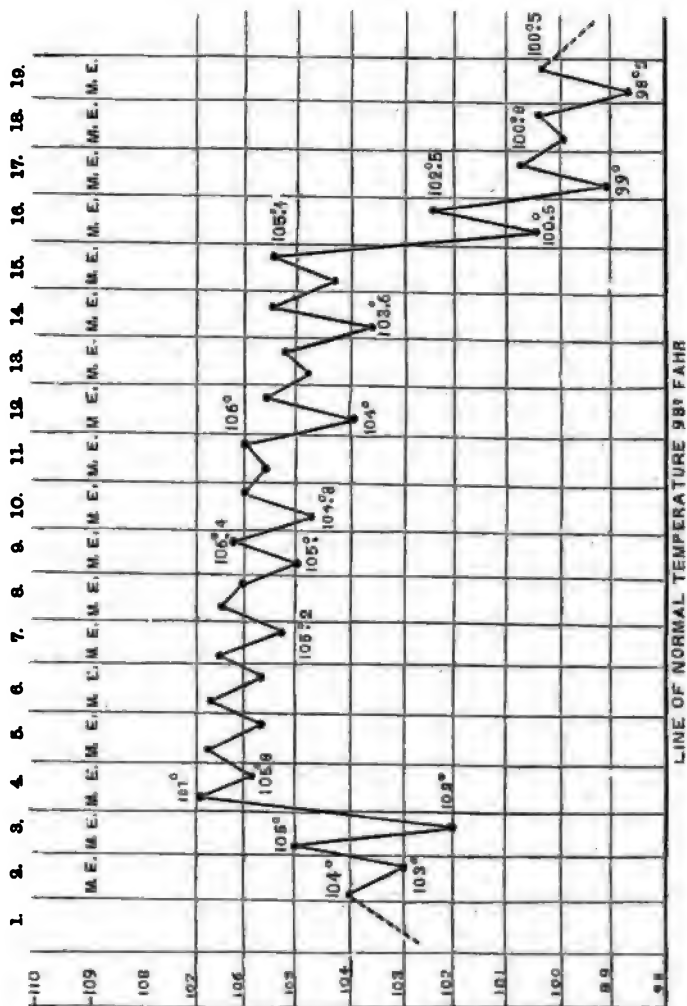
About the ninth or tenth day, and sometimes earlier, the delirium becomes decided, sometimes violent, and always unquiet, although the attention may still be fixed by a sharp question. At this time the patient is in some cases violent, and, unless restrained, leaves his bed to wander about the room; and the expression gradually comes to resemble that of a man unwilling to be roused from half-drunken slumbers. It now betokens complete stupidity, oppression, and decided prostration. The complexion, dull and dirty from the first, in the course of the second week becomes absolutely muddy, the conjunctival membranes injected, and the pupils contracted; and the danger of febrile coma, which may supervene, seems very much in proportion to the contraction of the pupil (W. T. GAIRDNER). The face is now often flushed—the flush being dingy and pretty uniform over the whole countenance; but occasionally somewhat more marked on the cheeks than elsewhere.

The eruption gradually becomes darker in hue, the centre of many of the spots, towards the termination of the second week, are unaffected by pressure, and here and there are to be seen some spots with well-defined outline, quite unalterable in appearance by the firmest pressure of the finger. These are true petechiæ. The posterior surface of the trunk is considerably congested, and the spots are there much darker and less affected by pressure than on the anterior surface.

About the tenth or eleventh day somnolence sets in, which gradually passes into stupor, or even coma, and the expression indicates profound prostration. The patient lies on his back, unable to turn himself in the slightest degree, and the urine is often passed involuntarily, or is retained, requiring the use of the catheter for its withdrawal. The tongue is thickly coated, dry, and dark brown, or even black, appearing as if baked, and perhaps unable to be protruded. The teeth are covered with sordes, the patient is unable to be roused for more than a minute or two, and when so roused he mutters incoherently. The conjunctivæ are intensely injected, and the pupils contracted. The skin is cool and occasionally moist. Miliary vesicles, or sudamina, are sometimes observed about the end of the second week, usually in the groins at the epigastrium, and under the clavicles. If such vesicles become hard at the summits, then black, and if then the mass drops out as a slough, leaving a circular ulcer, such a

vesicular eruption forebodes an unfavourable result (STOKES). The abdomen continues flaccid and indolent throughout. The bowels usually act once or twice a-day, the stools being somewhat relaxed.

TYPICAL RANGE OF TEMPERATURE IN A CASE OF *TYPHUS FEVER*. THE RECORDS INDICATE MORNING (M.) AND EVENING (E.) OBSERVATIONS.



The pulse, from the outset of the disease, is quickened, and it increases in rapidity in cases which terminate fatally, ranging from 100 to even 150 in a minute; or, after reaching a certain point, its frequency as gradually subsides till health is restored. Cases in which the pulse is remarkably slow are usually cases in which the prostration becomes extreme. A little cough and some sonorous r le are now and then present.

The skin throughout the whole course of the disease is often particularly sensitive, the slightest touch occasioning pain. The heat of the skin conveys also a burning pungent sensation—the temperature ranging from 102° to 107° Fahr. Griesinger, of Zurich, after insisting on the non-identity of typhus and typhoid fevers, has described the ranges of temperature in cases of typhus as particularly diagnostic and characteristic. (*Arch der Heilk*, vol. ii., p. 557, 1861.)

The course of typhus fever, although it may have some features in common with that of enteric or typhoid, yet shows great and numerous differences. In typhus, the fever, as denoted by the temperature, is maintained continuously for a longer time without interruptions. There is also a weekly periodicity traceable. The rise of temperature during the first half of the first week scarcely seems to differ from the course taken by enteric or typhoid fever, as may be seen on comparing the diagram at page 384.

If the temperature at the commencement before the fourth day does not exceed on any evening 103°·5 Fahr., the fever may be expected to run a mild course; and more especially if the increase of temperature takes place moderately, and is of limited daily duration during the beginning of the second week. In *mild* cases a small abatement of temperature takes place on the fourth day, which becomes more obvious by the seventh day; and this abatement is followed at the commencement of the second week by a small re-increase of very limited duration, after which the tendency to farther decrease reappears, and by the end of the second week or the beginning of the third, the normal temperature is again attained.

On the other hand, in *severe* cases the fever continues with great intensity, at least to the twelfth day, and mostly throughout the whole of the second week.

Defervescence rarely takes place before the first half of the

third week. Both in mild and in severe cases the temperature always rises above $104^{\circ}\cdot7$ Fahr., and it frequently reaches 106° Fahr. or more. The differences between the morning and the evening temperatures amount, during the fastigium (from the middle of the first to the middle of the second week), rarely to more than 1° Fahr.; and from the middle of the second week to a difference of about $1^{\circ}\cdot5$ Fahr. Greater differences happen only temporarily—a character which distinguishes typhus from enteric or typhoid fever, so far as ranges of temperature are concerned. But the difference between typhus fever and enteric or typhoid fever is rendered still more striking by their respective modes of defervescence. In typhus fever the defervescence shows no gradual remissions, as in enteric or typhoid fever; on the contrary, the defervescence of typhus fever is invariably sudden. It takes place precipitantly, and the normal temperature is reached sometimes in one night, mostly in twenty-four or thirty-six hours.

The disease generally terminates, if it proves fatal, from the twelfth to the twentieth day; and before death the prostration increases to the last degree. The average duration of Jenner's fatal cases was fourteen days; of Reid's, thirteen days. *Subsultus tendinum*, or involuntary twitchings of the muscles of the face and arms make their appearance. The face becomes dusky or even livid, and the breathing very quick, the pulse becoming so rapid and feeble that it can scarcely be felt. Some want of resonance of the most depending part of the chest may often be observed at this stage of the disease. The respiratory murmur at the same part becomes muffled, as if heard through a covering, and there is sometimes a little coarse, unequal crepitation. The urine, which is *now* secreted in large quantities—from three to four pints daily—is retained or passed into bed with the stools involuntarily. The skin at this time is often bathed in a profuse sweat, and the temperature is apt to fall below the natural standard. The patient lies on his back unable to move, or he sinks towards the bottom of the bed if his head be in the least elevated. Towards the middle or end of the second week a slough may form on the lower end of the spinal region, or on the region over the posterior spine of the ilium.

For a day or two before the fatal termination, the condition termed *coma-vigil* may come on. In this condition the patient

never sleeps. He lies on his back with his eyelids widely separated, his eyes staring and fixed in vacuity, his mouth partially open, his face pale and expressionless. He is totally incapable of being roused to give a sign of consciousness, the breathing is often scarcely perceptible, the pulse rapid and feeble, or unable to be felt, the skin cool, perhaps bathed in perspiration. Life is only known to have ceased by the eye losing its little lustre, and the chest ceasing to effect its slow and feeble movements. Dr. Jenner has never seen recovery from this condition. Death generally takes place without any return to consciousness, and by syncope rather than coma (MURCHISON).

If the disease should terminate in recovery, the improvement in the condition of the patient is frequently sudden. Some time between the thirteenth to the seventeenth day he may fall into a profound quiet sleep, lasting for several hours; and generally after from twelve to twenty-four, or even more hours, he awakes bewildered and confused, but decidedly improved in all respects—indeed, quite another man. At first he is bewildered or confused, and wonders where he is; but he recognizes his attendants and friends, and now he is conscious of his extreme debility. The complexion is clearer, the delirium has disappeared, the pulse has fallen in frequency and gained in strength, the conjunctivæ are no longer injected, the tongue is moist at the edges; there is perhaps a little appetite, the skin is softer and moist, the spots paler; the general powers improved, but he is conscious of extreme debility. His limbs retain their sensibility, but when he attempts to move them, they seem at first as if separated from the body, so great is the prostration induced by typhus fever (MURCHISON). In a few days the tongue cleans completely, the appetite becomes ravenous and insatiable, and the patient rapidly regains strength. Dr. Jenner considers the duration of the disease to be measured by the duration of the eruption; and the average duration of cases that recover, he states to be from fourteen to twenty-one days; although, not unfrequently, in very mild cases, the fever terminates before the fourteenth day. After twenty-one days, local lesions sufficient to cause death were always discovered in fatal cases of *typhus*. In other words, after the twenty-first day, death does not then occur *from the fever alone*, as may be the case before the twenty-first day. There are two very opposite

circumstances, under the influence of which the date of the first appearance of the eruption is changed, and its duration shortened. These are:—

(1.) A very mild attack of the specific disease; (2.) The development of severe local complications in the course of the specific disease.

There are cases of *typhus fever* which appear to die within a limited period after the outset of the illness, from the direct action of the poison on the blood or nervous system, and with the entire absence of local lesion, so that even the skin is not affected with eruption.

Condition of the Blood.—In *typhus fever* the microscopical characters of the blood are often such as to prove a marked deviation from its normal state. Amorphous heaps of red discs replace the normal rouleaus, and the adhesion of the red discs to each other, in the imperfectly formed rouleaus, is far less complete and long continued than in healthy blood. The red discs part with their colouring matter more easily, and dissolve more rapidly than they do in their normal state. This is shown by the red serosity found in almost every serous cavity, the deep dusky red hue of the flesh, and of every structure in contact with the blood. The blood drawn during life, or found after death in the vessels, is loosely coagulated or absolutely fluid (DR. JENNER). It is also more apt to become putrid when taken from the body during life, than healthy blood, or than blood in other diseases. According to Lehmann, the salts are increased rather than diminished; and there is good reason for believing that the unnaturally fluid state in typhus fever results from an abnormal amount of ammonia, possibly derived, as Dr. Murchison suggests, from the decomposition of urea; and there is evidence, as Drs. Richardson and Murchison have shown, that the blood of typhus fever contains an increased amount of ammonia.

Secondary Lesions and Complications of Typhus Fever.

1. Convulsions and Cerebral Affections.—The most formidable, and fortunately the most rare, is the occurrence of convulsions. When they do occur, the case almost invariably proves fatal, unless the convulsions occur in a patient who has suffered from epilepsy; and the subjects of them seldom present any morbid appearances after death, sufficient to account for their occurrence.

In *The Edinburgh Monthly Journal* for June, 1848, the details of six cases of typhus fever are given, five of which proved fatal by convulsions, in different wards of the general hospital there, and all of them within a period of twenty-one days, in the months of January and February. The following are the days of the fever at which convulsions are stated to have occurred, the number of hours they continued to recur, and the apparent mode of death:—

No. of Case.	Day of Fever.	Number of Hours the Convulsion Recurred.		Mode of Death.
1st. <i>Edin. Mon. Jour.</i> ,	7th	.....	2	Coma.
2nd. „ „	11th	.....	5	Coma.
3rd. „ „	15th	.....	6	Coma.
4th. „ „	14th	.....	24	Coma.
11th. Of Mary G—, related by Dr. Jenner,	11th to 13th	.....	72	Coma.
13th. Of Thomas B—, related by Dr. Jenner,	9th	.....	36	Coma.

Convulsions are found to occur during the invasion, the progress, and the decline of many acute diseases, and *typhus fever* is not an exception. Their occurrence in such cases may be fairly referable, in the present state of our knowledge, to the morbid condition of the blood in *typhus* fever, and the altered condition of the nervous system which ensues, and probably they have always a uræmic origin. With reference to the absence of any appreciable lesion in the brain, as in these cases, it may be remarked, that our usual instruments of research, applied to the nervous texture, are insufficient in all instances to indicate disease, even where it does undoubtedly exist. There are, for instance, physical conditions of texture, which are of the utmost importance in pathology, such as the specific gravity, and which are appreciable by the proper means and instruments of research even when the tissue of the organ presents to our senses no external evidence of disease.

The cerebral complications are generally attended with what are commonly called “head symptoms.” Dr. Jenner very emphatically calls attention to the fact, that the continuance of the headache complained of spontaneously after the commencement of delirium, is generally indicative of increased vascular action within the cranium. It may also be noticed that the headache which precedes the delirium is often in such cases of a very severe and constant kind, the face being sometimes pale and

sometimes red, and greatly expressive of the distress the patient suffers. The eye, haggard or brilliant, with its conjunctiva injected and its pupil contracted, is painfully sensible to the light, and is therefore generally closed. The least noise is insupportable, and the patient is troubled with noise in his ears. His temper also is altered, and his answers short and fretful. This condition is that of increased excitement, but not as yet of delirium, and, supposing the membranes of the brain to be inflamed, denotes diffuse inflammation of those tissues. At the end of a period of time, varying from two to ten days, the patient becomes delirious. His delirium may assume every character,—joyous or melancholy, furious or tranquil; and in some cases he wanders from subject to subject, while in others he incessantly recurs to the same theme, and even to the same few words. In others, though the cases are few, the disease assumes every character of insanity; and, if permitted, the patient, confined in a strait waistcoat, presents the extraordinary spectacle of being able, in typhus fever, to walk about the wards. The phenomena of this stage show that the inflammation of the membranes of the brain has extended to the substance of the brain itself. The commencement of effusion is indicated by the active delirium changing into a low muttering (*typhomania*), by the patient no longer requiring restraint, by his muscles becoming spasmodically affected with slight twitchings, or subsultus tendinum, showing how rapidly the nervous power is exhausted, and how feebly supplied; also by the pupil of the eye becoming expanded or contracted; by the fæces being passed involuntarily; by the urine being retained; and by the rapid grouping of those other symptoms, so happily described by Shakespere, as “the stony coldness of the feet creeping upward and upward,” “the babble of green fields,” and the “fumbling of the bed-clothes,” all indicative of approaching death. Intra-cranial serosity is generally decidedly increased; and hæmorrhage into the arachnoid occurred in one-eighth of Jenner's fatal cases. When the patient recovers, however, from this stage of cerebral complications, the appetite improves, the pulse becomes fuller and steadier, the countenance more tranquil, the mind firmer, and the sleep natural, till at last convalescence is fully established.

The respiratory movements are often also influenced by this cerebral condition. In the first week they do not exceed twenty

or twenty-four in the minute; but when delirium supervenes, and the pulse increases in frequency, they often rise to thirty or more, without any pulmonary lesion. In cases of great cerebral disturbance the respirations become sighing, irregular, spasmodic, or jerking, and then coma is apt to supervene. The "nervous respiration" of Dr. Corrigan, or what is sometimes also called "cerebral respiration," is denoted by a blowing or hissing sound in breathing, the lips being kept closed, the cheeks are distended, the nostrils dilate with each expiration, and the breath is forced through the closed lips with a puffing, blowing noise. Such breathing is irregular, a long pause being followed by a deep inspiration, and subsequently by short respirations in rapid succession. In some cases the action is entirely diaphragmatic, the respiratory muscles of the trunk being paralyzed (MURCHISON). The air expired has a disagreeable odour, most marked in the advanced stage of severe cases. It resembles the *typhus odour* exhaled by the skin, and which has been compared to the "odour of rotten straw," to the "smell of mice, deer, and certain reptiles," or to the smell of "the leaves of rue when rubbed between the fingers." By some it is spoken of as "pungent, ammoniacal, and offensive;" but is not to be confounded with the smell from urine being passed in bed. It seems to be, however, a smell *sui generis*, as Murchison very justly observes; and nurses experienced in typhus fever are quite familiar with it, and are able to distinguish cases of typhus fever by this peculiar typhus odour alone, which is always strongest in damp weather, and when the ventilation is bad; and it is highly probable that the typhus poison is contained in this odoriferous substance. The expired air of typhus contains a smaller quantity of carbonic acid and a larger amount of ammonia (MURCHISON, p. 134-137).

2. **Secondary Pulmonic Complications** are not uncommon in *typhus fever*, in the form of *pneumonia*. The congestion of the blood in the posterior parts of the lungs may give a tendency to this, and its presence may be suspected from the livid expression of the face, the existence of cough with rusty expectoration, the diagnosis being confirmed by the usual auscultatory means. It is seldom that pain is complained of. The part of the lungs affected for the most part is that which rests against the hollow of the fourth, fifth, and sixth ribs, between their tubercles and angles;

the position of the patient appearing to determine the place of consolidation. Such consolidations are not to be regarded as analogous to what we see in an ordinary pneumonia, occurring in an otherwise healthy person. The incubation of the lesion is latent, and the symptoms are masked, and the nature of the complication is only to be recognized by careful physical examination. The full expression of the morbid state is often for some time undecided, the exudation, being of a serous nature, is slow to solidify on the one hand, and yet the symptoms of resolution do not appear on the other. Dr. Hudson, of Dublin, attaches some importance to a certain tympanitic resonance, which becomes manifest over the diseased lung as a sign of the existence of the pulmonic lesion. He describes it as "a tympanitic clearness over the solidified lung, without air being present in the pleura." Dr. Lyons explains this abnormal clearness as the result of the increased pressure of the respiratory column of air in the permeable portions of the pulmonary lobules, which become expanded beyond their natural volume, and thus a condition of temporary emphysema is produced, which yields a clear sound on percussion (DR. STOKES in *Medical Times and Gazette*, May 26, 1855).

In some cases of pulmonary lesions there also appears to be a combination of circumstances which lead to a fluid or purulent state of the diseased part, resembling the third stage of pneumonia as described by Laennec. The conditions which lead to this form may be stated to be,—(1.) A sudden exudation and abundance of fluid matter; (2.) A great amount of tissue involved; (3.) Diminished vascularity and consequent (4.) Abeyance of absorption, tending to (5.) Increased fluidity of the diseased part; (6.) Breaking up or solution of the young and growing elements.

A lung in this condition seems to have passed, as it were, at once into this state, without any well-marked hepatization.

3. **Gangrene of the Pulmonary Tissue** is by far the most formidable of the thoracic secondary lesions of *typhus fever*. The hepatization of the lung is not, as in the last instance, obscure, but the consolidation is at once sudden, complete, and extensive, involving perhaps the greater part of a lung, and coming on without any marked physical signs different from what are to be heard in the simple congestion of *typhus*. A gangrenous cavity

forms in the substance of the solidified mass, and is only indicated by the fetid expectoration and the accompanying physical signs of a cavity. Large eschars, also, are apt to form towards the pleural surface, surrounded often with well-defined lines of demarcation where separation of the slough proceeds. In this gangrenous slough every simple element of the pulmonary tissue becomes disintegrated, sometimes perfectly liquefied; and sometimes it happens that the gangrenous cavity does not communicate with the bronchial tubes, and then the morbid state is difficult to diagnose, and its existence is often unknown till after death. With physical signs, the expression of the countenance of the patient is often highly suggestive. It suddenly becomes small, pinched, contracted, ghastly, miserable, and death-like. The eyes are sunk, and void of lustre; and along with languor, the patient feels nausea, and sometimes vomits.

Sometimes, as in a case recorded by Dr. Jenner, there are several distinct gangrenous centres, as if the lesion had been, from the first, disseminated or lobular.

4. **Secondary Cardiac Lesion.**—This lesion assumes the form which Dr. Stokes has called “typhus softening of the heart.” He is also inclined to consider that the muscles of the larynx and the circular muscles of the trachea are sometimes similarly affected, as well as the involuntary muscles generally. This complication has for the most part occurred when there was a great amount of the secondary bronchial disease. The wasting of the involuntary muscles is always great in typhus. In the heart it is more obvious than in the arterial or systemic portion.

The cardiac phenomena of typhus (adynamic) are chiefly indicated by a diminution of the impulse, and an impairment or loss of the first sound—the impulse diminishing progressively from the fifth or sixth day to the termination of the disease—while the systolic sound becomes daily more feeble or quite inaudible, leaving the second sound clear and distinct.

The poison, however, does not necessarily make itself manifest through all the series of local secondary affections already referred to. Thus, in one year the lungs will be attacked in every case; in others, the bronchial membranes or the membranes of the brain; while in other years such attacks will be rare,—the exception, and not the rule of the disease.

Prognosis.—With regard to the prognosis in typhus fever, the

occurrence of certain phenomena, or the presence of certain symptoms, indicating the existence of complications, are the main guides to an opinion. These have been very fully expounded in Dr. Murchison's work, and may be arranged in the following summary under three heads, namely:—

1. Combinations of Symptoms and Phenomena which are of extremely unfavourable import.—(1.) A presentiment of death on the part of the patient; (2.) A pulse of 120, which at the same time is soft and compressible, small, fluttering, irregular, intermittent, reduplicate, or imperceptible; (3.) Complete absence of cardiac impulse, and an audible systolic sound; (4.) An excited or thumping action of the heart, associated with a very feeble radial pulse; (5.) Hurried respiration, whether "cerebral" or due to pulmonary lesion; (6.) Sleeplessness, associated with delirium, both of which being persistent; (7.) Severity of cerebral symptoms, and these symptoms coming on early; (8.) The occurrence of complete "coma-vigil;" (9.) Extreme contraction of the pupil; (10.) Extreme prostration occurring early; (11.) Muscular tremor, picking and catching at the bed-clothes, subsultus, and spasmodic twitchings of the muscles of the face; (12.) Urgent and protracted hiccup; (13.) Rigidity of the muscles of the limbs, and squinting; (14.) Relaxation of the sphincters before the tenth day; (15.) Retention of urine; (16.) Tympanitis, with extreme nervous prostration; (17.) A dry, brown, hard, retracted, tremulous tongue; (18.) The more abundant and darker the eruption the greater the danger and severity of the case; (19.) Great lividity of the face and extremities, and a dusky erythematous condition of the skin on the dependent parts of the body; (20.) Continuous profuse sweating, coldness of the surface, cold breath, and a rapid weak pulse; (21.) A sudden diminution in the amount of the excretion of urea; (22.) The occurrence of blood or albumen in the urine before the tenth day, especially when associated with casts of the uriniferous tubes; (23.) Pulmonary hypostasis and bronchitis, pneumonia, gangrene of the lungs, convulsions, pyæmia, erysipelas, parotid-swelling, inflammatory swellings, bed-sores, gangrene, renal disease, scurvy, the gouty diathesis.

2. Combinations of Symptoms or Phenomena which may be regarded as of favourable import.—(1.) A sudden fall in the frequency of the pulse; (2.) When a patient, after lying for days on his back, helpless and motionless, manages to turn himself round and sleep

on his side, or if he is able to draw up his leg and rest it on the foot in the flexed position in the bed; (3.) Cases without rash, or in which the rash is scanty; (4.) When the excretion and elimination of urea and uric acid continues free and copious; (5.) Sudden cessation at the end of the second week of several of the unfavourable symptoms and phenomena; (6.) Diminution of the rapidity and increase in the strength of the pulse; (7.) A slight return of appetite, while the tongue becomes clean and moist at the edges; (8.) A diminution of the dusky tinge of the face, a less stupid appearance of the countenance, and a less injected state of the conjunctivæ, with signs of returning intelligence.

3. Modes of Fatal Termination.—(1.) Death during the primary fever may occur from syncope or from coma. In the former case the heart's action is enfeebled from paralysis or disease of its muscular tissue. In the mode of death by coma the blood has undergone such modifications as render it incapable of supporting the changes essential to existence. Its contamination seems mainly due to the admixture of urea and other products of the retrograde metamorphoses of tissue, and from the diminution and destruction or solution of its red corpuscles. (2.) Death is for the most part due to a combination of syncope and coma; and, as a rule, the patient is quite unconscious for a considerable time prior to death. (3.) Death may occur from one of the many complications which happen before or after the cessation of the primary fever.

Morbid Anatomy.—The morbid anatomy of cases of typhus fever has been carefully investigated by Gerhard and Pennock, A. P. Stewart, John Reid, Thomas Peacock, William Jenner, Felix Jacquot, Barrallier, and Murchison. All are agreed that there is no constant nor characteristic lesion; and they may be summed up generally as follows:—"A fluid condition of the blood; hyperæmia of the cerebral membranes and increase of intra-cranial fluid; bronchial catarrh and pulmonary hypostasis; softening of the heart, liver, spleen, and pancreas; hyperæmia and hypertrophy of the kidneys" (MURCHISON, p. 245).

Treatment of Typhus Fever.—Before considering the treatment of typhus fever, it is of the greatest importance to be aware of the changes which go on in the system during its progress. Dr. Parkes has observed the nature of these changes in a most conclusive manner. His observations are of great scientific interest,

and of important practical bearing. ("Gulstonian Lectures," in *Medical Times and Gazette* for February 28, 1857.) In an uncomplicated case of typhus fever the body loses flesh rapidly, owing not only to diminished ingress of food, but also to increased egress of bodily structures in the form of excretory products. The metamorphosis of tissue, as judged by the urine, is augmented. The only complete analysis of the urine in an uncomplicated and undoubted case of *typhus fever*, when no medicine whatever was given, is an analysis made and recorded by Dr. Parkes. (*Urine in Disease*, p. 258.) "The condition of the urine," he writes, "was that of ordinary pyrexia. The water was lessened; the urea was increased one-fifth; the uric acid was in large amount, and spontaneously, or on the addition of an acid, deposited. The chlorides were entirely absent; there was no diarrhoea or sweating; the sulphuric acid was rather high; the phosphoric acid was not determined. The free acidity was very slight; and (differing from many pyrexiae) the pigment and extractive matters were throughout in small amount. The urea continued large, and the chloride of sodium small in amount, for some days after the temperature had fallen to below the normal limit. The excretion of urea was remarkably regular in amount from day to day; for during ten febrile days its range was only 15 grains (1 gramme) below the mean of the ten days, and 20 grains (1½ gramme) above it. And this took place with great alterations of temperature. It then, as usual, fell during convalescence, and rose again to the healthy standard in three or four days. The chloride of sodium was clearly retained in this case, for there was constipation, and the skin was dry, so that none could have passed off by the intestines or surface." "It would seem also," he further observes, "that the urine in typhus is much more frequently albuminous than in typhoid fever."

In three cases of typhus fever associated with jaundice (which is extremely rare in typhus cases), Dr. Murchison examined the urine, which was also jaundiced. There was no re-action on testing for the bile acids; but in two of the cases *tyrosine* and *leucine* were found. In one of these cases the urine was almost devoid of urea. At the autopsies of two of them there was no derangement of the biliary ducts. (*Path. Soc.*, Feb. 3, 1863.)

The following inferences are drawn from the table given by Dr. Parkes:—

1. In spite of the many pints of fluid drank, a small quantity of water left the system by the kidneys and skin, and none at all by the bowels. This retention of water is not peculiar to typhus, and its cause is quite unknown.

2. The amount of urea was greatly increased. The normal amount of urea excreted by active men on good diet, between twenty and forty years of age, weighing 145 lbs., is 491 grains in twenty-four hours. A boy ill of typhus, aged seventeen, weighing not more than 129 lbs., excreted not less than 532 grains daily, although he was on fever diet, and taking scarcely any nitrogenous food.

3. The chloride of sodium is excreted in health at the rate of 180 grains daily. In this case of typhus fever it was present only in traces, the amount being too small to be determined. Like the water, this retention is common to the pyrexia.

4. Metamorphosis of tissue was more active by one-fourth daily.

General Indications for Treatment.—From most careful observations such as these, Dr. Parkes thus gives an outline of the principles upon which fevers are to be treated. The treatment of fever (and *typhus* and *typhoid* fevers are not exceptions) may be summed up as being a combination of measures *to reduce excessive heat*, to insure *proper excretion*, and *to act on the semi-paralyzed nerves*; and, as Dr. Murchison justly observes, “every remedial agent which shall be found to promote the elimination of urea, without increasing the destructive metamorphosis of tissue, will deserve a trial in typhus” (l. c., p. 268).

To reduce heat and to regulate elimination are but secondary indications in the treatment of *typhus* fever compared with the influence which must be exercised over the nervous system; and one of the greatest objects of therapeutics at the present day is to find substances which will act on the nerves and the blood, and restore them in some way to their normal action.

Special Indications for Treatment.—Our objects in this treatment of typhus fever should be,—(1.) To neutralize the poison and to correct the morbid state of the blood; (2.) To eliminate the poison and the products of the destructive metamorphosis of tissue; (3.) To reduce the temperature; (4.) To sustain the vital powers, and to obviate the tendency to death; (5.) To relieve the distressing symptoms; and (6.) To avert and subdue local complications (MURCHISON, p. 265).

1. In the belief that the morbid condition of the blood in typhus fever may be due to the presence of ammonia in some as yet unknown combination, the use of mineral acids has been recommended by many physicians. Murchison considers their beneficial effects in typhus as undoubted, and in this opinion he is confirmed by the experience of Huss of Stockholm, Haller of Vienna, and of Mackenzie, Chambers, and Richardson, in this country. Huss recommended phosphoric acid in doses of ten to fifteen drops every second hour, believing that the phosphorus exerts a special influence on the brain; but in the advanced stage, and especially if sweating, numerous petechiæ, or ecchymoses be present, he has recourse to sulphuric acid in doses of fifteen to twenty drops every hour or every second hour. Hydrochloric acid is preferred by Drs. Murchison, Richardson, Mackenzie, and Chambers. It may be given to the extent of one fluid ounce of the dilute acid, mixed in a quart of barley water, sweetened with syrup of ginger, and flavoured with lemon peel. Dr. A. P. Stewart has used with advantage the *tinctura muriatis ferri*, in doses of half a drachm every three hours. Dr. Murchison recommends the nitro-muriatic acid. He prescribes twenty minims of *hydrochloric acid* with ten minims of *nitric acid* every three hours, each dose being diluted with the patient's drink. But if the "typhoid state" is developed in a marked manner, *dilute sulphuric acid* in doses of fifteen to twenty minims every three hours in combination with *ether*, and small doses of *quinine* are to be had recourse to as in either of the following formulæ:—

R. Acid Hydrochlor., dil. m. xx; Acid. Nit. dil., m. x.; Spt. Æther. Nit., ʒi; Liquor. Cinchonæ, m. xxx.; Decoc. Scopar. comp., ʒi. *misce*. A draught so composed may be administered every third hour.

Or, R. Quinæ Disulph., gr. ½; Acid. Sulph., dil. m. xx. ad. xxx.; Æther. Sulph., m. xv. ad. m. xxx.; Syrup. Aurant., ʒi.; Decoc. Scopar. comp., ʒi. *misce*. A draught so composed may be administered every third or fourth hour.

2. To insure proper excretion and elimination in fever is much more difficult than to reduce temperature, which latter condition, for obvious reasons, it is not always wise to attempt.

Perhaps the best general method to insure proper excretion is to supply the system with abundance of *alkaline salts*, which are not now given in the food, and to maintain the action of the kid-

neys, the bowels, and the skin. *Chloride of sodium*, the *alkaline salts of potash*, and probably also those of *soda*, tend to aid the formation of urea and its elimination. In the use of *nitrate of potash* and of *iodide of potassium*, which are not natural constituents of the frame, Dr. Parkes has observed that, at the first employment of these, there is often a marked lessening of excretion, as if the chemical processes then going on in the body had been interfered with, for afterwards the elimination again increases as if the system had accommodated itself to the remedy.

Purgatives tend to insure a proper excretion, probably by removing from the blood some of the abnormal products formed in fever. The great relief which sometimes follows their use, as well as the fall of temperature, seem to show this. Where there is retention of urea, they aid its elimination, because we know that urea passes off sometimes by the mucous membrane of the stomach and bowels. The patient should be allowed to drink freely of water; and five grains of the *nitrate of potash* may be given with each dose of the nitro-muriatic acid already mentioned. Dr. Murchison also recommends *nitre whey*, prepared by boiling 3i of nitre in a pint of milk, and straining; or a drink prepared by dissolving 3i to 3iir of the *bitartrate of potash* in a pint of boiling water, and flavoured with lemon peel and sugar; but if the patient be very prostrate, or if the bowels be relaxed, *nitric ether* is to be substituted for the *nitrate of potash*.

Tea and coffee have been recommended in the stupor of typhus; and it is probable, as Dr. Parkes has shown, that their good effects are due to their power of eliminating the urea already formed in the blood. The coffee may be given as an extract, or as a strong infusion of the powdered berry made in the ordinary way. Tea has been recommended as an infusion of the green tea leaf. As beverages or common drinks in fever, both tea and coffee have been found to relieve the headache, the pulse becoming fuller and stronger under their use. Böcker, L. Lehmann, and Hammond, all agree in showing that in health they greatly lessen the urea. (Parkes *On the Urine*, p. 76.) With respect to *chloride of sodium*, Dr. Murchison recommends that large quantities of this salt should be given with the beef tea.

The action of the bowels is to be maintained by emetics and laxatives. In the first instance, if the patient is seen early, *i. e.*, before the sixth day, an emetic of *ipecachuana* (one scruple),

and of antimony (one grain), or of carbonate of ammonia (two scruples), in place of the antimony, is to be administered. If the bowels remain confined after the emetic, a mild laxative of rhubarb and calomel, or of castor oil, is to be given; and failing these, or in place of them, a simple enema is to be administered (MURCHISON, p. 269). The advantages of emetics are, that they relieve the patient to some extent by mitigating or removing headache and general pains. They also reduce the temperature, abate thirst, and quiet gastric disturbance.

Emetics, however, are contra-indicated if the patients are unusually weak, or if the disease has advanced beyond the first week. Laxatives and enema, however, ought to be repeated daily, if required, so as to secure a motion of the bowels once a-day. In this respect alone the treatment is totally different from the treatment which ought to obtain in typhoid fever, as already mentioned. Excrementitious matters in the intestines must be removed by gentle aperients. The dark offensive matters accumulated in the intestinal canal in typhus fever, may have a secondary deleterious effect on the system if they are allowed to remain. Purging, however, in typhus fever is to be avoided, and *fresh-made* compound rhubarb pill mass, which *tends to stimulate the peristaltic action of the intestines*, is as good a medicine as can be given, followed, if necessary, or alternated, by a small dose of castor oil, or by a simple enema.

Diaphoresis is not to be encouraged beyond the insensible transpiration of the skin; and to remove which the wholesome detergent of tepid water sponging is most beneficial. It ought to be used twice or three times daily, and quantities of *Condy's fluid* or of *muratic acid* (3i ad Oj.) may be mixed with the tepid water (MURCHISON). The measure is a good one in a hygienic point of view, and it contributes—

3. To reduce temperature, for which the external application of cold water was once practised to an extreme degree by Currie. In health such an application as that of cold water has a great effect in reducing temperature, and tends to increase metamorphosis (LEHMANN, SANDERSON).

4. The vital powers are to be sustained by food in the first instance. For this purpose, nourishment ought to be given often, and at stated intervals—at least once every three or four hours after the fourth day of the fever. Even if the patient is

asleep, or seems to be so, he must be roused at these stated intervals (not oftener), to take his food or his stimulants. But if, towards the period of the crisis, the patient appears to be in a sound sleep, he ought not to be disturbed. The indications for treatment just described apply to the earlier stages of the fever, up till about the fourteenth day.

Alcohol in small quantities, as well as tea, coffee, and other substances, have a directly stimulant action on the nervous system, and on the organs of circulation; at the same time they diminish the metamorphosis of the tissue elements. Few remedies, however, require more discrimination in their use; and the following guides for their administrations are compiled from the careful observations of Dr. Murchison (l. c., p. 269):—

1. Wine is not usually required during the first five or six days of the illness, but most cases require some stimulants during the second week; and, as a rule, the physician may begin to administer stimulants about the seventh or eighth day.

2. The indications for the administration of alcoholic stimulants are mainly derived from the state of the organs of circulation; and the profession is indebted to Dr. Stokes (1839) for pointing out the importance of cardiac and radial pulses as guides for the use of alcohol in fever.

These indications are,—

- (a.) Extreme softness or extreme hardness and compressibility of the pulse. An irregular, intermitting, or imperceptible pulse more imperatively demands stimulants than a merely rapid pulse. So also an abnormally slow pulse—*e.g.*, 40 to 60—is also a stronger indication for stimulation than a quick pulse.

- (b.) When the cardiac impulse becomes weak, and when the first sound is impaired or absent, a liberal allowance of stimulants is demanded; and in every case where there are doubts as to the propriety of giving stimulants, the heart must be examined with the hand and with the stethoscope, because the state of the pulse alone is not sufficient to judge from. The impulse may be found to diminish progressively from the fifth or sixth day to the termination of the disease, and for several days prior to death or recovery it may be entirely absent. The systolic sound of the heart also becomes daily more feeble, and ultimately may be quite inaudible, leaving the second sound clear and distinct; and before the first sound is altogether lost, it may become so

short that it is difficult to distinguish it from the second sound. If the action of the heart be rapid, its sounds may thus come to resemble closely those of the *fetus in utero*. A violently excited heart all through the disease, with cold surface, cold breath, and feeble pulse, demands wine from the first, but even with its judicious use the prognosis in such cases is extremely doubtful (STOKES, GRAVES, MURCHISON).

Other indications for stimulants may be stated as follows:—

(c.) If by raising the patient to his semi-erect position a tendency to syncope is induced, or great prostration is manifest with diminished strength and volume of the pulse, then stimulation must be commenced.

(d.) The darker and more copious the eruption, the more is the necessity for stimulants, especially if *pétéchiæ* are numerous.

(e.) Profuse perspiration, with no improvement in the general symptoms, requires an increased supply of stimulants.

(f.) Coldness of the extremities, stupor, low delirium, tremor, subsultus, involuntary evacuations—symptoms generally of the “typhoid state”—are indications for the liberal administration of alcohol; but the propriety of giving stimulants in delirium depends on the state of the pulse. If, on the trial of stimulants, the patient becomes tranquil, they do good, and may be continued; if the reverse, their use must be suspended.

(g.) A dry brown tongue is an indication for wine or brandy, and if it becomes clean and moist at the edges under the use of either, such stimulation is beneficial.

(h.) Complications, as a rule, increase the necessity for stimulation; and large quantities of stimulants are called for if *pyæmia*, *erysipelas*, *bronchitis*, *pulmonary hypostasis*, *pneumonia*, *inflammatory swellings*, *bed-sores*, or *local gangrene* should supervene.

(i.) Persons who have led intemperate lives, and old persons, require stimulants to be given early in the fever, and in large quantities.

The effects of alcoholic stimulation require to be most carefully watched throughout the whole period of their administration. Four ounces of wine in the twenty-four hours is enough to begin with; for if the blood be overloaded with the products of alcoholic ingestion, farther alcoholic stimulation will lead to increased contamination, and it is rare that more than eight ounces of brandy in twenty-four hours are necessary.

There are differences in the demand for stimuli in the typhus of different countries, and in the fever of different epidemics. Dr. Wood tells us that in America cases requiring wine or brandy are extremely rare. Dr. Stokes says that the *typhus* in Ireland demands large quantities of wine. In Scotland, also, wine is the great mainstay of the *typhus fever*, requiring often to be administered largely.

Port, Sherry, Marsala, Madeira, brandy, gin, or whisky possess no peculiar advantages apart from the alcohol contained in each. Spirits contain from fifty to sixty per cent. of alcohol, Sherry and Port from seventeen to twenty-four per cent., and malt liquors from six to eight per cent. Two fluid ounces of spirit will thus be equal to five or six of wine, and spirits ought to be given diluted; and if the prostration is great, and when the skin is cold and covered with perspiration, the best stimulant is brandy or whisky punch, given as hot as it can be taken, in small quantities at a time frequently repeated. In urgent cases stimulants ought to be given every hour, and, as a rule, a larger quantity will be required during the night and early morning than in the daytime, for it is usually towards morning that temperature tends to get low and the vital powers are at their lowest ebb (MURCHISON). At the same time it must ever be remembered, as Dr. Jenner justly observes, that "in no disease is the advantage of refraining from meddling more clearly displayed than in typhus fever; and in no disease is the prompt use of powerful remedies more clearly indicated. It is in determining when to act, and when to do nothing, that the skill of the physician as a curer of disease, in the case of fever, is shown. Interfere by depletion or by stimulation, when nothing should be done, and the patient is lost, who, if it had not been for you, would have been safe. Refrain from depletion or withhold stimulants, when the one or the other is required, and the patient sinks into that grave from which judicious treatment might have saved him."

A large well-ventilated apartment, fresh air, a cool but not a cold atmosphere, quiet, abstinence from solids, and a free supply of water, milk and water, coffee, weak broth, beef tea, according to the discretion of the physician, are the conditions and remedies on which a large majority of cases will recover. But the patient must be constantly and carefully watched, and there is no disease

where the attentions of a well-instructed nurse are more demanded; and there is no class of patients in hospital so apt to be neglected by the attendants, especially as to the regular administration of the remedies prescribed. It is not uncommon to find that the wine allotted for the day has been administered at a draught, when it ought to have been given in small quantities at regular intervals, with care and watchfulness. How often do we see almost hopeless cases recover under the careful nursing of an intelligent person, regulated by the dictates of common sense and conscientious solicitude, guided by the judicious directions of a physician who knows well the nature of the disease with which he has to deal? The nurse ought to note down the hours at which food or medicine has been given, or any remarkable change in the symptoms. She might also, if she were instructed, take observations with the thermometer, for the information of the physician at each visit.

Dr. Murchison recommends that, in urgent cases, food and alcoholic stimulants must be persisted with as long as the patient is able to swallow; and even when he can no longer swallow, the case is not to be given up; for, he has seen cases where life appeared to be saved, by frequent enemata of beef tea and brandy, after the patient had ceased to take anything by the mouth.

Of special symptoms which call for relief, the most urgent is generally headache. If headache should persist after delirium sets in with a rapid pulse (*e. g.*, 120), attended with nausea, some saline effervescing mixture, with four drops of hydrocyanic acid, may be given every six hours. In the persistence of headache, dry cupping, such as has been recommended by Dr. Sieveking, might furnish an aid to guide the treatment by determining whether it may not depend upon repletion or upon emptiness of the cranial vessels. When applied to the nape of the neck, dry cupping may afford relief if repletion has to do with the continuance of headache. Under such circumstances the face is generally flushed, the conjunctivæ red, and the skin dry and hot. If the dry cupping does not relieve such symptoms, the hair must be shaved off the head and the scalp covered with crushed ice enclosed in a bullock's bladder, or recourse may be had to the cold effusion. The application of cold water is best effected by bringing the patient's head over a basin at the ed-

of the bed, and having a vessel arranged so that the cold water (at 40° or 50° Fahr.) may drip continuously from a height of two or three feet upon the head (MURCHISON). A skein of worsted arranged in the water with the ends overhanging the basin, will maintain a constant flow of water from the basin, and which may be directed to fall upon the scalp. Dr. Murchison recommends that in young subjects two or four leeches may be applied to the temples; and in aged or infirm persons warm fomentations to the head are advisable (GRAVES and MURCHISON). But if anæmia is the cause of the headache, as may be suspected from the state of the vascular system, then stimuli are called for. Four to six ounces of wine may be given in divided doses during the day and night of twenty-four hours. If the pulse continues to get weaker, the wine must be increased.

The headache of typhus naturally abates about the eighth day; but it is sometimes rendered worse by sleeplessness; and if the remedies for the headache do not relieve it, nor tend to induce sleep, then opiates may be given, combined with antimony, if the skin be dry and hot and the pulse of good strength. Dr. Murchison thinks that the employment of opium in typhus is more dreaded than it ought to be. The dose of opium should be given about 9 P.M., followed in two hours by half the dose if the patient does not sleep. The form of the opiate and dose may be ten minims of Battley's solution of opium, or fifteen minims of the solution of the muriate or acetate of morphia, or five grains of the compound soap pill. Dr. Murchison also teaches us to distinguish two forms of delirium as a guide to the administration of opium, combined with antimony in the one form, and with etherial stimulants in the other. When the condition of the patient approaches more to that of *delirium ferox*, the cardiac and radial pulses being of good strength, after trying the cold effusion and remedies already mentioned, then opium combined with antimony ought to be given without delay. Dr. Murchison suggests the following prescription:—

R. Liq. Opii Sedat., ʒi.; Antim. Potas. Tart., gr. i. ad gr. ii.; Mist. Camph., ʒvi.; *misce*. A large spoonful of this mixture is to be given every hour until sleep is induced.

On the other hand, if the delirium approaches in its character that of *delirium tremens*, the radial pulse is usually quick and

feeble, the cardiac impulse diminished, and the first sound of the heart more or less inaudible, then the opium must be combined with alcoholic or other stimulants, the amount being regulated by the state of the pulse and heart. Dr. Murchison suggests the following prescription:—

R. Liq. Op. Sed., ʒss.; Æther, Chlor., ʒi.; Mist. Camph., ad ʒiij.; *misce*. Commence by giving two table-spoonfuls of this mixture, and repeat it every hour till sleep is obtained. Or opium to the amount of half a grain may be combined with three grains of camphor in a pill, and such a pill may be repeated, if necessary, every two hours.

Cases requiring such treatment ought to be seen at least three or four times daily. If dyspnoea is urgent, and lividity of the face betoken pulmonary lesion, defective arterialization of the blood and venous congestion of the brain, opium in any form must be withheld; and it must likewise be discontinued if any tendency to stupor supervene, or if there be any marked contraction of the pupil—*e. g.*, “*the pin-hole pupil*” of Dr. Graves. This physician proposed the use of *belladonna* in such cases, and he, as well as Dr. Benjamin Bell and Dr. Murchison, bear their united testimony to its usefulness. Dr. Graves prescribed it as follows:—

R. Ext. Belladonna, gr. i.; Ext. Hyoscyami, gr. vi.; Pil. Hydrar., ʒi.; *misce*. This mass being divided into six pills, one may be given every three hours; or it may be given in the form of a draught in the following prescription:—R. Ext. Belladonna, gr. i.; Pulv. Moschi, gr. x.; Mist. Acaciæ et Syrup. Aurant, ā ā ʒiij.; Mist. Camph., ʒss.; *misce*. A draught of this composition may be given every six hours.

Dr. Murchison considers that musk and camphor are stimulants of very great value, which have fallen into unmerited neglect. Camphor may be given in emulsion in doses of *five* grains every two hours; or in the form of an enema in doses of a scruple. Huss and Graves also bear testimony to the good effects of these remedies. In a case of complete sleeplessness Dr. Graves gave the following combination of these medicines with the best results:—

R. Antim. Pot. Tart., gr. ss.; Pulv. Moschi, gr. x.; Camphor, gr. v.; Tinct. Opii, gtt. x.; *misce*. A similar draught may be given every two hours; and after the third dose the patient will generally fall into a quiet sleep.

When there is danger of stupor passing into profound coma Dr. Murchison has seen the best effects result from a small cupful of a strong infusion of coffee given every three or four hours, employing at the same time such measures as have a derivative action on the kidneys, *e.g.*, dry cupping; mustard poultices to the loins; wet compresses of thickly folded flannel, wrung out of hot water, passed round the loins, and covered with a piece of waterproof cloth, retained in its place by a bandage or a towel. These remedial agents are all the more necessary if the urine contain either blood or albumen. At the same time free evacuation from the bowels should be secured by a purgative or by a turpentine enema. If the lethargic state supervenes early, and before there is great exhaustion, the douche has been found to be of great service as a stimulant, provided there be considerable elevation of temperature, and little irritability of the nervous system (TODD, ARMITAGE, MURCHISON).

The region of the bladder should be examined by the physician at least two or three times daily, by manipulation and percussion; and if there be the slightest doubt as to its containing urine, the catheter must be introduced.

Origin and Propagation of Typhus Fever.—It is yet uncertain whether great overcrowding and vitiation of air by the organic impurities emanating from the respiratory and other functions will absolutely generate typhus fever *de novo*. In all the English wars (for “typhus fever is a disease as old as the disputes of nations”) there has always been plenty of typhus poison waiting for favourable conditions to assume activity. This arose from the peculiar system of recruiting. Commissions or commands of regiments were wont to be given to those who collected a certain number of men. Every low purlieu, every infamous haunt, every jail even, used to be ransacked for recruits. Wherever these men went they carried typhus, at that time the constant scourge of our towns and our jails; and complaints of the introduction of typhus fever from this source are frequently found in the writings of army surgeons of the last century. In connection with this point, Dr. Donald Munro, in 1764, gives the following caution:—“That particular regard be paid to those soldiers picked up in the streets, or who have been taken out of the Savoy or other jails. All dirty rags from such people should be thrown away or burnt” (DR. PARKES, l. c.) There is now ample proof that

typhus fever may be communicated *by fomites* adhering to apartments, articles of clothing, and the like; and, provided fresh air be excluded, it is known that such articles will retain the poison for a very long time. Herein lies a fallacy which pervades the argument from cases, to prove the generation of the disease *de novo*. The poison may be said (like that of small-pox) to be constantly in existence. Dr. Murchison quotes some instances of the generation of the disease *de novo*, and its subsequent propagation by *fomites*, which are capable of a totally different interpretation. For example, he refers to the instance related by Foderé, in which the soldiers of the French army, during their retreat from Italy in 1799, communicated fever to the inhabitants of towns and villages where they halted on their route. But he omits to connect this with the fact that typhus prevailed to a great extent in the towns they besieged, and in some instances obtained possession of. He also quotes the recent instance of the Egyptian vessel, the "Scheah Gehald," at Liverpool, the crew of which disseminated the poison of typhus by their clothes and persons, although, as he says, they had not the disease themselves. But this is an error. The careful investigation made by Dr. Parkes into the history of this epidemic on board the Egyptian ship, clearly shows that the crew suffered from typhus fever. (*Statistical, Sanitary, and Medical Reports of the Army Medical Department for 1860*, p. 359.) The facts of the case have been curiously confused; but the following statement, from the above and other sources, may be relied on:—A number of men (476, chiefly Arabs) were shipped on board the "Scheah Gehald" at Alexandria, to proceed to Liverpool to navigate back a man-of-war then in that port. The weather was cold and stormy, the hatches were battened down during a lengthened voyage of thirty-two days from Malta; and the men, unaccustomed to the rigor of a Northern winter, and not provided with suitable clothing; crowded below for warmth and shelter. Even they whose turn it was for duty had to be driven up on deck. They were extremely crowded on board, and the space below deck was quite insufficient for so large a number (for the crews of two vessels were on board); and there was no attempt to promote ventilation. The persons and clothing of the men were filthy in the extreme. The space between the decks soon became intolerable from filth; for many of the men being

landsmen were sea-sick on the voyage, and they discharged the contents of their stomachs and bowels in all parts of the ship, which, on arriving at Liverpool, was so offensive that it had to be sunk in the graving dock. Moreover, the rations served to the men were much below the proper standard as regards quantity. Several deaths occurred on the voyage; and although the captain denied the existence of fever and the occurrence of deaths, his statements are quite untrustworthy, for on arrival in Liverpool thirty-two men had to be sent to the Southern Hospital. Two died soon after admission, and their disease was returned as dysentery; and Mr. Pemberton, on whom the duty of receiving and treating the patients at first fell, was convinced that he had some kind of fever before him in the persons of these sick Arabs. He called the disease "febris;" and in writing to a friend, expressed his belief that it was a "gaol fever." The heat of skin, the sordes on the teeth, and the marked symptoms of stupor in some cases and furious delirium in others, led him to this conclusion, although he could not see the eruption on the dusky skins of the Egyptians; and perhaps, as he had never seen a case of typhus fever before, he might not have recognized the eruption, as Dr. Parkes suggests, even if present. This diagnosis, however, was made at once by Mr. Pemberton, and before fever had been communicated to any residents in the hospital. It is impossible now to ascertain how many of the thirty-two Egyptians had this fever; but five had marked, and several others had slighter symptoms. Many of the patients (typhus and others) had dysentery, and several were frost-bitten.

Indubitable typhus fever, with a well-marked rash, was communicated by these men, and by Mr. Pemberton himself (who had a well-marked rash), to another medical officer, and to two nurses, a porter, and some patients. The chaplain, also, who slept out of the hospital, but visited the sick men, was attacked, and died in twelve days. In all, nineteen persons contracted typhus in the Southern Hospital, three on board the ship after she came to Liverpool, and three at the Liverpool baths. Six died of these twenty-five persons. "No single link of evidence," says Dr. Parkes, "is wanting here to show that typhus prevailed on board the ship; and that typhus patients admitted from the ship into hospital communicated the disease to a number of other persons. The idea that the Egyptians

suffered only from dysentery, and that in some remarkable way a specific disease like typhus arose out of this dysentery, does not appear to have the slightest foundation. To urge such an hypothesis in the face of the simple facts above noted, is to ignore all evidence, and to render the progress of medical science impossible. Cases of typhus were not only communicated to residents in the hospital, but to persons who boarded the ship, and to three attendants at the public baths, to which more than 200 of the crew were sent. Some of these men were sick, though they were not known to have typhus. They carried typhus, however, in some way—perhaps in their clothes—and communicated it to the attendants. The remaining crew (350) of the ‘Scheah Gehald’ were sent to Alexandria on board the ‘Voyageur de la Mer.’ The people of Liverpool were probably so glad to get rid of them, that they did not take the trouble to see that the typhus fever had been eradicated, and several of the men were sent at once from the Southern Hospital. The ‘Voyageur de la Mer’ lost some men on the passage, and landed several at Falmouth, and some, with unequivocal typhus, at Malta; and of thirteen Englishmen who were in her, six took the disease.”

“The case of this Egyptian vessel,” continues Dr. Parkes, “afforded almost the best opportunity seen in this generation for the investigation of the important question of the spontaneous generation of typhus. The opportunity was, however, lost. That all the circumstances which have been supposed to be capable of calling into existence the specific poison of typhus were present in this foul and filthy ship is clear; but every one who reads all the published statements will at once perceive that one link of the chain of evidence is wanting, and that it has *not* been proved that some of the crew were not ill with typhus when they embarked at Alexandria, or became ill within the incubative period. On the contrary, the interpreter informed Mr. Pemberton that some of the men were sick when they came on board. It can never now be ascertained whether there were such cases or not, and the history of the outbreak at Liverpool affords another instance of the loss of a great opportunity for definitely setting at rest a most important question.” The case of the “Scheah Gehald” now assumes exactly the same aspect as the many former instances referred to by Dr. Murchison—namely, that however plausible may seem the probability, there is *no proof*

that typhus fever arose *de novo*. Seeing that such is the state of the question as to the origin of typhus—that it is exactly in the same state as our knowledge regarding the origin of small-pox or of typhoid fever—that it has been in existence from the earliest periods of the world's history—that it is undoubtedly propagated from pre-existing *foci*, and by continuous succession, the immediate direction of investigation ought to bear especially on the following points, namely:—How long can the typhus poison exist or be maintained in a condition fit to assume activity under favourable circumstances? What is the distance at which it is potent? Has temperature any influence upon it? What are the conditions or combination of circumstances more or less essential to the development and propagation of the typhus poison?

The fact that typhus fever is contagious is based on evidence which shows,—(1.) That, when typhus commences in a house or district, it often spreads with great rapidity; (2.) That the prevalence of typhus in single houses, or in circumscribed districts, is in direct proportion to the degree of intercourse between the healthy and the sick; (3.) That persons in comfortable circumstances, and living in localities where the disease is unknown, are attacked on visiting infected persons at a distance; (4.) That typhus is often imported by infected persons into localities previously free from it; (lastly), That its contagious nature is indicated from the success attending the measures taken to prevent its propagation, more especially the early removal of the sick. Dr. Murchison fully illustrates by examples all of these statements.

The specific poison seems capable of transmission in various ways; but many circumstances seem to point to the cutaneous and pulmonary exhalations of the sick as the media which convey the specific poison from the diseased to the healthy. It is thus conveyed through the air or by fomites. That particles of organic matter are constantly floating in the air no one can doubt who has seen the ingenious contrivance of M. Pouchet put in practice, and the substances so suspended in the atmosphere collected, by drawing a current of air through a funnel with a very small opening. Immediately below the opening the covering glass of a microscope slide is placed, with a drop of glycerine spread over it. Upon this the current of air impinges, and any

solid or corpuscular bodies floating in the air may be in this way arrested and examined with the microscope. Dr. Parkes has detected by this method unequivocal epithelium cells in several instances; and Eiselt, in a ward containing thirty-three children with acute purulent ophthalmia, was able to detect pus cells floating in the air. (*Army Med. Dep. Sanit. Report for 1860*, p. 346; also, *Comptes Rend.*, 1861; and *Med. Times and Gaz.*, 1861.)

Such material particles, capable of conveying the specific poison of a disease, such as typhus, are thus inhaled or swallowed in the saliva, and so they find admission into the bodies of the healthy, to exercise their morbid influence on the blood. A peculiar pungent odour emanates from the typhus fever patient. It is especially obvious from the breath, and from the skin on turning down the bed-clothes.

There is no evidence to show the extent of space through which the typhus poison can be transmitted through the air. From some observations it would seem that the contagious influence of typhus is confined to a narrower sphere than that of small-pox. Dr. Murchison concludes that "if a patient be placed in a large well-ventilated apartment, the attendants incur little risk, and the other residents in the same house none whatever.

"There are likewise no grounds for the popular belief, that typhus may be propagated through the atmosphere from a fever hospital to the houses in its neighbourhood. On the other hand, medical attendants who auscultate typhus patients, or who inhale their concentrated exhalations from under the bed-clothes, run no small danger, and the danger is always increased or diminished in proportion to the supply of fresh air" (MURCHISON, l. c., p. 80). There are also good grounds for believing that typhus fever may be communicated, and even carried a great way, by fomites, or by articles of clothing strongly impregnated with the specific poison; and, provided fresh air be excluded, the efficiency of the poison may be maintained for a long time. "Complaints of the introduction of typhus from this source are frequently found in the writings of army surgeons of the last century. Typhus was several times carried to the West Indies, and even prevailed there apparently to some extent." (Parkes *On the Causes of Sickness in English Wars.*) The poison may also adhere to the walls of dwellings, to beams of wood, and to

articles of furniture. Dr. Murchison quotes an account by Pringle of twenty-three persons being employed in refitting old tents in which typhus patients had lain; and seventeen of these persons died of the infection. He also refers to an observation of Lind, who mentions several instances in which infected ships continued to impart the disease long after the original sick had been removed. Similar cases are recorded by Jacquot respecting the Crimean typhus.

Nurses and other attendants in fever hospitals are well aware of the danger of contracting typhus from infected clothes, and from cleaning the bedding of the sick; and in some instances they are in the habit of "measuring the amount of danger by the badness of the smell." Thus they are liable to contract typhus fever without having had any direct communication with the sick. With regard to the kind of clothing most apt to retain and convey the specific poison, woollen textures are found to be the most dangerous. Haller of Vienna has made experiments on this point. He observes that *dark*-coloured materials of clothing are more apt to absorb the contagion of typhus, and to convey it to other individuals, than those which are light-coloured. He found that among troops wearing dark-coloured uniforms, it more frequently happened that new cases of typhus entered the hospital after a convalescent patient joined his corps, than those wearing light or white uniforms. Stork also found, and the fact has been often observed, that in dissecting-rooms dark clothes acquired the cadaveric odour sooner, and were deprived of it less readily than light ones; and he ascertained by experiments that the absorption of odours is regulated by the laws which govern the absorption of light. Haller also found that the specific poison of typhus fever is lighter than atmospheric air. When the under storeys of a hospital were filled with typhus patients, those in the upper storeys were always observed to become infected, when there was a communication between the air of the two storeys. On the other hand, when only the upper storeys contained cases of typhus, the patients in the under part of the house enjoyed perfect immunity. (*Ed. Med. and Surgical Journal*, 1853.) Dr. Murchison has observed that, if the poison be very concentrated, the length of the period of exposure sufficient to contract the disease is very brief—not more than a few minutes; and the latent period during which it remains in the body, without

betraying its presence in any way, has been very variously estimated. Nine days is the result of Dr. Murchison's observations. Instances, however, are not uncommon in which the disease manifests itself almost instantaneously after exposure to the poison. In such cases these extremely susceptible persons are generally conscious of the peculiar and offensive pungent odour emanating from the beds or bodies of the sick. They are generally then immediately seized with prostration, nausea, rigors, and headache, followed by the regular development of the disease. Such persons are thus almost conscious of the moment at which the poison entered their system. On the other hand, the length of time between exposure and attack may be greatly prolonged. In my own case I was three months in daily and close attendance, in the fever wards of the Dundee Infirmary, for many hours on cases of typhus fever before taking the disease. In such cases, however, of prolonged exposure, it is probable that the constitution may be susceptible at some periods rather than at others; but of the conditions of such susceptibility nothing is known.

Opinions vary as to the stage of the disease at which the typhus poison is most powerful. Some consider that it is so during the period of the eruption—others that it is so during the period of convalescence. Dr. Perry was of this latter opinion, and Dr. Murchison's observations lead him to confirm the opinion of Perry; but he is inclined to think that the disease is really most apt to propagate itself from the end of the first week up to convalescence, when the peculiar odour from the skin and lungs is the strongest.

The conditions essential to the propagation of the specific poison of typhus fever are mainly as follows:—(1.) Overcrowding, co-existing with deficient ventilation; (2.) Personal squalor, and filthy apparel saturated with cutaneous exhalations; (3.) A deteriorated state of the constitution, such as may result from protracted starvation, scurvy, and other debilitating causes; (4.) A moderate temperature. Dry heat is a powerful disinfectant.

RELAPSING FEVER—*Febris Recurrens*.

Definition.—*A continued fever, having a very abrupt invasion marked by rigors, chilliness, and severe headache, vomiting, and*

often jaundice; a white moist tongue, epigastric tenderness, confined bowels, enlarged liver and spleen, high-coloured urine, a frequent, full, and often bounding pulse, pains in the back and limbs, restlessness, and occasionally delirium. These symptoms abruptly terminate by an exceedingly copious perspiration between the fifth and the eighth day; and after a complete apyretic interval (during which the patient may be so well as to get up and walk about), an abrupt relapse supervenes on the FOURTEENTH day from the first commencement. The relapse runs a similar course to that of the primary paroxysm, and terminates between the third and the eighth day. In some cases a second, third, fourth, and even fifth relapse may occur. Death is apt to happen from sudden syncope, especially after the excessive perspiration; or from suppression of urine and coma. No constant eruption and no specific lesion are associated with this fever.

Pathology.—The name by which this disease is known is derived from one of the most constant and striking peculiarities of the fever. It is also sometimes described under the various names of “five” or “seven-day fever,” “seventeen-day fever,” “bilious remittent fever,” and “bilious relapsing fever,” “mild yellow fever,” “synocha,” “short fever,” and “short relapsing fever.” Epidemics of this form of fever have been recognized to prevail on different occasions since 1739. In Dublin it prevailed at that time and in several subsequent years. Sometimes it has been described as a variety of a well-known form of fever, and at other times as a new disease.

In Scotland in 1817-18 this fever was clinically recognized and described by Drs. Christison and Welsh; and when it reappeared as an epidemic in Edinburgh and Leith in 1843, Dr. Christison had no difficulty in again recognizing it. About this time it also appeared in Glasgow as an epidemic about a month before its outbreak in Edinburgh; and subsequently it became prevalent in Dundee and other large towns in Scotland. It was observed with great accuracy, and its phenomena were recorded in the medical journals of the period by Drs. Craigie, Alison, Arrott, Henderson, Douglas, Jackson, Mackenzie, Cormack, and Wardell. It formed a part of the fever epidemic of Ireland in 1817-18-19, described by Barker and Cheyne; and it had been prevalent in Ireland for many years. Epidemics of it were described by Rutty, in his *Chronological History of the Diseases of*

Dublin, as early as 1739 and 1741. In most of the periods of epidemic fever referred to, the commencement of the epidemic was characterized by the greater preponderance of cases of relapsing fever; and as the epidemic advanced the number of cases of relapsing fever gave place to a preponderance of typhus cases (STEELE, R. PATERSON, ORMEROD, MURCHISON). In 1847 it became again epidemic in Glasgow, Edinburgh, and the large manufacturing towns of Scotland, as well as in London, when it was carefully described by Dr. Jenner, who, moreover, shows that its characters have remained constant since they were first described by British physicians. During the same year it prevailed in some parts of the Continent, and more especially in the Prussian province of Upper Silesia, and in some other parts of Germany. There it has been described by Virchow, Bärensprung, Dümmler, and Suchanek. These observers, however, did not know or recognize the fever so well and precisely described by the Scotch physicians; and indeed Dr. Parkes was the first to indicate, in his admirable paper on *The Diagnosis of Fevers*, already noticed, that the epidemics these German physicians described were mainly made up of the relapsing fever. This fever evidently formed the great bulk of the cases. Yet, although its characters are thus so striking that the most superficial observer could not fail to recognize them, the German systematic writers (except Virchow) make no allusion to relapsing fever as a separate and distinct disease; and even those who observed the fever in Germany failed to draw that obvious inference to which the Scotch physicians unanimously came—namely, that *relapsing fever* is a disease altogether distinct from *typhus* and from *typhoid fever*; if it is not so, “we know not,” as Dr. Parkes observes, “that any medical evidence whatever can be relied upon.”

In the summer of 1855 it prevailed, after the hardships and privations of the preceding winter, among the British troops in the Crimea, where it was recognized and described by Dr. Lyons. It has not been observed in France, nor in any other part of the continent of Europe.

The observations of Dubois, Austin Flint, and others, leave no doubt that relapsing fever was seen in New York, Buffalo, and other parts of North America, in 1847 and 1848; but Dr. Murchison is of opinion that all the cases are traceable to Irish immigrants, and that there is no good ground for believing that the

disease is indigenous in America. It has been well described by Dr. Wood, of Pennsylvania, from the writings of the physicians already mentioned. In India and in all tropical countries it is as yet unknown.

Since the epidemic of 1847 and 1848, Dr. Murchison writes that relapsing fever has been gradually disappearing; and for the seven or eight years previous to 1863 not one case has been observed in the hospitals of Edinburgh, Glasgow, or London. Professor W. T. Gairdner has not seen or heard of a single case at Edinburgh since 1855; and according to Drs. Lyons and M'Ewen, true relapsing fever has of late years been a rare disease in Ireland.

Like other continued fevers, its specific cause is unknown, but it selects its victims from the poor and ill-fed, who live miserably in crowded, filthy, ill-ventilated apartments, rather than from the wealthy and well-fed, who live in comfort and in well-aired abodes. Its poison appears to be of a specific kind, and the phenomena of the fever are very different from those of *typhus* and *typhoid fever*. Patients recovering from either *typhus fever* or *typhoid fever* may catch, by contagion, the *relapsing fever*, while patients convalescent from *relapsing fever* may also take either of the forms of *continued fever* already described. It has been supposed by some (DR. CORMACK) to be identical with the malarious form of *yellow fever*; but there is not sufficient evidence to establish the point. It seems more nearly to approach in its nature some forms of remittent fever, on account of the repetition of the rigors, often at regular daily periods, for two or three days (DR. PEACOCK). The marked periodicity of its relapses, which "come on like a fit of ague almost to an hour" (DR. R. PATERSON), and the enlargement of the spleen to a greater extent than in any other form of fever (JENNER), point also to a malarious origin. On the other hand, epidemics of relapsing fever, as Murchison shows, appear to commence, progress, and decline, quite irrespectively of the season of the year.

The evidence that a specific poison exists and is formed in cases of relapsing fever, and when so formed is communicable from the sick to the healthy, rests on evidence similar to that adduced in cases of typhus; and the same objections may be taken to the evidence which aims at establishing the spontaneous

generation of the specific poison. There are causes, circumstances, or conditions which obviously favour the accession of relapsing fever, and no doubt, also, its occurrence in an epidemic form; and chief amongst these predisposing causes must be placed destitution and want of food, while the names applied to the disease by different countries indicate the popular belief as to such predisposing causes being credited with originating the disease in the first instance. Thus it is spoken of as the *famine fever* of the British Isles and the *hunger pest* of Germany.

The Primary Paroxysm.—The seizure is generally, indeed, almost always, sudden. Sometimes on waking in the morning, or when employed in business, severe rigors at once come on, with a sense of chilliness and frontal headache. These phenomena are more severe than their expression in the commencement of typhus. There is slight prostration of strength from the first, but rarely so severe as in typhus. If premonitory symptoms exist, they usually manifest themselves by pains in the limbs and lassitude, nausea, and perhaps vomiting, with feeling of prostration. Subsequently, and very soon, febrile re-action sets in, sometimes violent, expressed by intense heat of skin, severe headache, throbbing temples, intolerance of light and sound, suffusion of face, sleeplessness, remarkable anxiety of countenance and jactitation, with a very rapid pulse—so rapid as to range from 110 sometimes as high as 140 beats in a minute; the tongue is coated with a white fur, and, in a great majority of cases in some epidemics, there is uncontrollable vomiting of greenish, bitter fluid, with or without epigastric tenderness, and great thirst. The pains in the muscles and joints are sometimes so severe as to resemble rheumatism, and when the pain in the back is severe, together with the rigors, the vomiting, and the headache, it may not be possible in the first instance to say that the attack may not prove to be one of small-pox. But the pain in the back is not generally so severe, nor is the vomiting so incessant in cases of *relapsing fever* as in cases of *small-pox*. The headache is to be distinguished from what is commonly called a “sick headache” or “bilious headache,” by the circumstance that the “bilious headache” is in most cases *occipital*, and the heat of skin, combined with the quick pulse, serve to distinguish an attack of relapsing fever at its outset from one of “bilious headache.” From idiopathic head affections

disease is indigenous in America. It has been described by Dr. Wood, of Pennsylvania, from the already mentioned. In India and elsewhere it is as yet unknown.

Since the epidemic of 1847 relapsing fever has been frequently observed in the hospitals of Professor W. T. Gairdner in Edinburgh since 1847. It is a true relapsing fever of Ireland.

Like other fevers, at the same time full and of considerable intensity it selects the symptoms not indicative of commensurate danger—in crowded rooms, with profuse and lasting for several hours, but without relief to the headache and other symptoms. Almost no sleep is obtained, and the little obtained is dreamy and unrefreshing. The skin continues dry after the sweating ceases; or after the primary rigors, if sweating has not taken place; and the heat of skin is ardent—as much as 102° to 107° Fahr.; and these febrile phenomena are occasionally varied by short rigors or slight sweating. Delirium does not generally supervene on the first attack, although, by the fifth or sixth day, just before the crisis, it has been in some cases of a violent kind. In a large proportion of cases there is decided jaundice, and in others the skin exhibits a bronzed hue. The jaundice is not attributable to any obstruction of the *ductus communis choleloechus*, as bile passes freely, and even copiously, with the stools, and as, after death, the gall duct is pervious. There is generally tenderness over the region of the liver in such cases; and it may be enlarged. Thirst is excessive; the appetite absent or voracious, and the bowels constipated. The tongue, at first moist, is covered with a white or yellow fur, which it may retain throughout the illness; and, in many cases, it may become dry all over, or with a brown dry streak down the centre, after the third or fourth day.

The Crisis.—After the patient has continued in this state for a period varying from five to eight days, a sudden change takes place, immediately preceded, in most cases, by an exacerbation of all the symptoms. "When every symptom appears hourly

suddenly
the joints and
the symptoms
the patient takes
to feel weak, but
out of bed, or of
is pleurodynia in a
indications of pleuri-

most invariably exceeds
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as rarely 140 on the second day of

graver—when the restlessness and general distress
 ed their highest point—then ensues a most remark-
 phenomena, followed by a remarkable intermission
 aptoms, and an apparent restoration to health.”
 received the name of “Crisis,” and super-
 n or about the *seventh* day, and its advent
 beyond the *eighth*. This change is ushered
 perspiration, in some instances with an
 sicles, which breaks out from the whole
 in the course of a few hours the
 nearly well. More rarely the change is indi-
 epistaxis as well as by perspiration, or by profuse
 orrhoea, catamenial discharge, or hæmorrhage from the bowels;
 and after either or all of these apparently critical changes
 have been established for a few hours, there is a complete
 and abrupt cessation of all the bad symptoms. The pulse
 quickly regains the natural standard, the tongue cleans, the
 appetite and sleep return, and the countenance resumes its
 tranquillity. This alteration is very often effected within a
 few hours, and on the following day the patient generally con-
 siders himself in all respects quite well, and may so continue to
 improve rapidly for *four* or *five* days. During this period,
 however, there are some patients who suffer from violent mus-
 cular pains in the limbs.

The Relapse.—About *seven* days after this critical change, or be-
 tween about the *twelfth* to the *twentieth* day from the commence-
 ment of the illness, but generally on the *fourteenth* day, a sudden
 relapse occurs “in ninety-nine cases out of every hundred.” This
 relapse commences suddenly, like the first seizure, by rigors,
 headache, loss of appetite, vomiting of green fluid, which is quickly
 followed by a hot skin, quick pulse, and a coated white tongue,
 confined bowels, followed by delirium, so that the phenomena may
 be exactly represented as a repetition of the first attack. In the
 interval of convalescence between the first and second attack
 the pulse often becomes slow to an extreme degree, as slow even
 as forty-five to sixty beats in the minute; but, suddenly, on the
 relapse commencing, it again rises to 120, or more. In ordinary
 favourable cases perspiration would again occur in *two*, *three*, *four*,
 or *five* days, and the patient would be relieved as before. The
 chemical qualities of the sweat have never been determined in

cases of relapsing fever; but it has a very sour and peculiar smell. In other cases, however, uncontrollable vomiting, great thirst, very rapid pulse, a hectic-looking circumscribed flush of countenance, jaundice, watchfulness, delirium, and death, may terminate the case.

In some cases the relapse is very slightly marked, and indicated merely by a comparative increase in the rapidity of the pulse and a greater heat of skin than were present on the previous day. The duration of the relapse varies from a few hours to several days; the average being from *three to five days*, or less than that of the primary paroxysm. In some cases the relapse lasts less than *twenty-four hours*; and in a few it is prolonged to *seven or eight days* (MURCHISON). The relapse is rarely prolonged beyond these periods in uncomplicated cases, but Dr. Lyons observed in the Crimea that the fever of the relapse was occasionally protracted to *twenty-one days*. (Lyons *On Fever*.)

If blood be taken from the arm it is generally buffed, but it is *not* to be argued that *therefore* the lancet must be used in *relapsing fever*. So far as can be ascertained, no local inflammation attends it.

In nearly a fourth of the cases, according to Dr. Jenner, jaundice is present, and is sometimes intense. If present during the first attack it may disappear before the relapse, and not recur; or, it may occur only on the relapse: and it is important to notice, that while the jaundice continues, the stools still retain their natural hue, and may even be darker than common, and at the same time the urine may be frequently loaded with bile. Epigastric tenderness is most marked in the cases where vomiting occurs. When pregnant women are attacked with *relapsing fever* they usually abort, sometimes in the first paroxysm, but often in the relapse, and this event renders the prognosis more doubtful.

There is a tendency in *relapsing fever* to the occurrence of sudden death. It may happen by syncope, immediately after the critical periods, when the pulse becomes so very slow. It may also happen during the progress of the case, during either of the severe periods—namely, during the primary attack or during the relapse. It is indicated by a deep dusky hue of the face, lividity of the hands and feet, and a purple marbling of the whole surface. The trunk feels cool, and the hands feel cold, and without suffer-

ing any severe pain, or without sustaining any sudden discharge of fluids, a state of collapse insidiously comes on, from which the patient is unable to be roused, and death may follow in a few hours, generally from *twelve to twenty-four*, even after it was supposed that danger had been escaped. But death is a rare termination to relapsing fever; and when it does occur, the fatal event more commonly happens during the primary fever than during the relapse (DR. JENNER).

A second relapse, and a third, a fourth, and even a fifth, are reported to have occurred during epidemics of *relapsing fever*, but the cases are of rare occurrence.

Duration of the Fever, and Convalescence.—Under ordinary circumstances, when there are but two paroxysms—*i. e.*, one primary paroxysm and one relapse—the total duration of the fever extends to about *three weeks*; and the convalescence is very slow—much slower than in typhus. The *relapsing fever* is very exhausting in its effects upon the constitution; and dating the period of convalescence from the termination of the last attack, the time taken to recover is in most cases unusually long. To those, indeed, who suffer from more than one relapse, it is almost impossible to have health completely restored for a long time. They become a prey to various sequelæ of fever, or they continue sickly for months, with pallid countenances, puffed ankles, palpitations, extreme debility, noises in the ears, dimness of vision, diarrhoea, or dysentery. Dysuria is a frequent complication amongst women during the relapse. In many instances during the epidemic of 1847 and 1848 in Ireland, convulsions occurred in cases which otherwise seemed to be progressing favourably, and death invariably followed them. Dr. Wm. Robertson observed in Edinburgh (and the Irish physicians record a similar observation) that delirium of a violent character occurred during convalescence, or after the critical discharge had taken place. It generally came on suddenly, with incessant talking, a rapid weak pulse, followed by perfect unconsciousness, flushed face, and contracted pupil.

No special anatomical lesion has been pointed out as peculiar to *relapsing fever*. The most constant lesion is enlargement of the spleen, the size attained by that organ being on the whole larger than in either typhus or typhoid fevers. Dr. Jenner has recorded the weight in one case to have been as much as thirty-

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eight ounces, and of a size in proportion. Its substance is generally softened, sometimes diffuent. It is usually seen at its largest size when death occurs during the final paroxysm; but if death occurs during convalescence, the spleen is of a normal size. Occasionally pale, red, fibrinous infarctions are found in its substance and near its surface. They are easily broken down, have a fine granular fracture, and are considerably firmer than the surrounding splenic tissue, from which they are separated by a distinct line of demarcation. As a rule, there is but little congestion of the lungs, the weights of which contrast singularly with the weights of organs in subjects dead of typhus fever.

The blood in a few cases has been found fluid throughout the body after death; but generally, when drawn from the body during the febrile paroxysm, it is buffed; and decolorized coagula are found in the heart and large vessels after death more frequently than in cases of typhus. In several cases urea has been detected in the blood in considerable quantity. The proportion of white corpuscles is increased—a fact of interest in connection with enlargement of the spleen, and the state of anæmia so commonly observed (CORMACK, ALLEN THOMSON, MURCHISON). The liver is generally large, and the gall bladder filled with dark thick bile.

Sequelæ of Relapsing Fever.—One of the most common results is the occurrence of excessive pains in the limbs, more especially expressed about the knee and ankle joints; and even the long bones appear to be the seat of these pains in some cases. Combined with those local pains, the joints may swell; and the kidneys are in danger of being implicated. In some respects, therefore, the dangers are similar to those which attend scarlatina. The lymphatic glands are also liable to swell, and so is the parotid gland. Anasarca and furunculi may likewise supervene.

The most important of all the sequelæ, however, is a remarkable affection of the eyes—a form of ophthalmitis—which Dr. Mackenzie first described under the name of "*post-febrile* ophthalmitis." It may occur during the course of the fever, but more often during convalescence, and even some months after convalescence has been established. It was very common in Glasgow after the epidemic of 1843; and assumed two different forms, namely,—(1.) An active inflammation of the shell of the eyeball

and of the iris; (2.) An amaurotic state due to congestion of the choroid and the retina (DR. ANDREW ANDERSON).

These two forms of disease, Dr. Anderson observes, may be associated with two characteristics of the fever itself—namely, “the tendencies to visceral congestions, and to rheumatic-like pains;” while the constitutional character of the ophthalmia is in many cases proved by the unhealthy aspect of the blood, which flows dark, in some cases almost tarry, from the vein. Bleeding is found to be the most effectual—the only effectual—mode of cutting short this dangerous ophthalmia; and a very small loss of blood is found to be sufficient. This is especially noticeable, because, during convalescence, tonics and quinine are most likely to be thought of.

Treatment.—All physicians agree that in the primary attack little medicine is required, after opening the bowels by castor oil; or by five grains of the compound colocynth mass; or by two grains of blue-pill, and three grains of extract of hyoscyamus given at night, and followed in the morning by two drachms of the sulphate of magnesia in compound infusion of roses (MURCHISON). The symptoms are not readily under the control of remedies; the vomiting is often especially persistent. *Five* grains of calomel, with *one* grain of opium, has been found more efficient in subduing the severity of this symptom than counter-irritation or effervescing draughts. The violence of the headache in well fed, or otherwise healthy patients, is best subdued by leeches or cupping; and in the poor, weakly, and ill-fed, by blisters to the nape of the neck, or by dry cupping there. Till the crisis comes, the symptoms may be mitigated, but not altogether relieved, and cases of ordinary severity are better left to nature, without interference on the part of the physician. Active purging is to be avoided; and the action of the kidneys is to be kept up by the frequent use of small doses of nitre (ROSS, HENDERSON, CORMACK, WARDELL, MURCHISON). “By keeping up the action of the kidneys from the first,” Dr. Murchison justly entertains the hope that we may “prevent the occurrence of anæmic intoxication, which is one of the main causes of death in uncomplicated cases.” He recommends the administration of the nitre as follows:—

From one to two drachms of nitre are to be dissolved in two pints of barley water, acidulated with a drachm of dilute nitric acid, and

sweetened with a little syrup. This quantity is to be used up during the twenty-four hours. Acetate of potash and nitric ether may be used for the same purpose; but the nitre has the additional advantage of keeping open the bowels.

The surface of the body should be frequently spunged over with cold or tepid water; stimulants are not usually necessary, but they may be required in the stage of languor or exhaustion ensuing on the crisis; or in cases where great debility has preceded the attack. If any anæmia exists, or if an anæmic murmur can be detected, stimulants must be given early. When jaundice appears Dr. Murchison recommends that nitro-hydrochloric acid should be given in combination with nitre, as in the following formula:—

Twenty minims of hydrochloric acid, with ten minims of nitric acid, every three hours, each dose diluted with the drink of nitre and barley water already prescribed.

Contamination of the blood with urinary products is the great danger in cases of relapsing fever; and therefore, in all cases of relapsing fever, particular attention must be paid to the state of the urine, especially towards the period of the first crisis. When the daily amount is much reduced, or if entire suppression should ensue, and particularly if stupor, confusion of thought, or drowsiness should supervene, the bowels are to be freely moved by compound jalap powder, or by a turpentine enema. Determination to the skin should be promoted by the hot air bath; and saline diuretics may be given every two or three hours (MURCHISON). No means hitherto discovered will prevent the occurrence of the relapse.

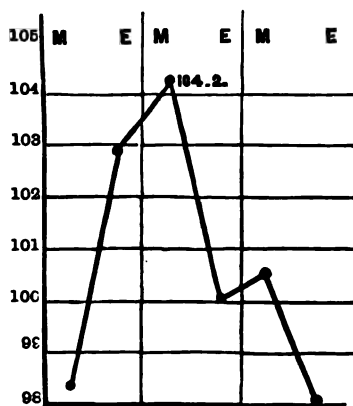
SIMPLE CONTINUED FEVER, OR FEBRICULA—*Febris Continua*.

Definition.—*A fever in which the expression of the febrile phenomena is of very short duration, lasting, as a rule, for twenty-four, thirty-six, forty-eight, or seventy-two hours or more, attended with a frequent, full, and often firm pulse, white and coated tongue, pains in the loins and limbs, thirst, constipation, a scanty discharge of high-coloured urine, hot and dry skin, sometimes an eruption of roseola or erythema about the loins or thighs, coming and disappearing with the fever (MOREHEAD); severe headache,*

sometimes acute delirium, and flushed face. The subsidence of the fever is generally associated with copious perspirations, or herpetic eruptions.

Pathology.—We do not know of any specific poison as the cause of such phenomena as those detailed in the definition; neither have we any evidence that simple continued fever is a contagious or miasmatic disease. There are many different causes which are known to be capable of exciting expressions of febrile phenomena similar to those mentioned in the definition,—such as exposure to great heat or cold, surfeit, inebriety, mental or bodily fatigue or excitement; and specific poisons, in uncertain or otherwise mild doses, such as the typhus or enteric fever poisons. It is also associated with local and functional disturbances—*e. g.*, catarrhs (bronchial, gastric, intestinal, urethral), milk fever, the fever of alcoholism. Such cases are especially characterized by the apparent severity of the febrile state, the shortness of its course, and the absence of any local complication or specific eruption.

TYPICAL RANGE OF TEMPERATURE IN A CASE OF SIMPLE CONTINUED FEVER OR EPHEMERA. THE RECORDS INDICATE MORNING (M.) AND EVENING (E.) OBSERVATIONS (Wunderlich).



LINE OF NORMAL TEMPERATURE, 98° FAHR.

The pathology of such apparently simple continued fevers demands extensive investigation, and especially in the tropics, where it is a very common disease. The *ardent fever*, the *sun fever*, the *common continued fever* of Burmah and India generally,

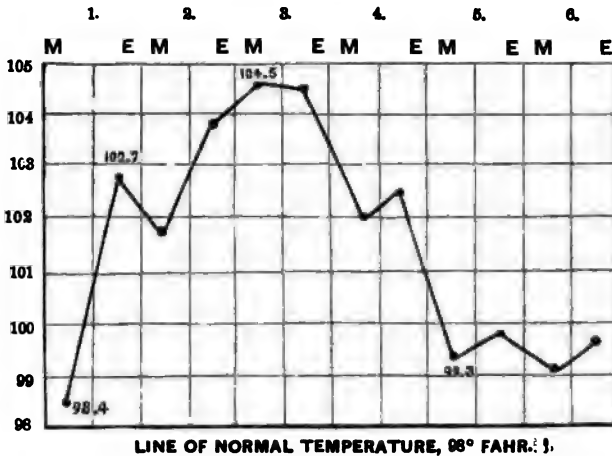
are all names which indicate severe or protracted cases of febricula—cases of fever which “differ in degree rather than in character” (MOREHEAD). They are common in those parts of India which do not experience much of the influence of the monsoon rains. Cases of true febricula commence with chills, followed by re-action, and this by perspiration. They are characterized by a quick and comparatively sudden rise of temperature, as indicated by the preceding diagram.

Such fevers are characterized by a rise of temperature in a few hours to 4°, or 5°, or 7° Fahr. above the normal temperature of 98° Fahr. They have a sudden beginning and a rapid arrival at a maximum—phenomena which are only shared in by some forms of *malarious fever (intermittent)*, *variola*, *measles*, and *pneumonia*. The defervescence also is characteristic. In febricula the maximum of temperature may only last for a few hours, or a single day, when the defervescence sets in rapidly; so that in twenty-four or thirty-six hours the body will have returned to its normal heat—an example of *pure crisis*. No other febrile disease gives expression to similar phenomena; and the co-relation of temperature to the other phenomena, especially to the excretion of urine, is also peculiar. The urine presents, during this disease, the very type of febrile urine. On the second or third day, according to Dr. Parkes's own observations, the amount of urine is extremely small (twelve to twenty ounces), of very high specific gravity (1035-1037), with the solids and sulphuric acid very much over the average, and the amount of urea large. When the temperature falls the quantity of urine rapidly augments. The increase of urea and of the solids is not so much, however, as in the height of the more severe and prolonged fevers. (PARKES *On the Urine*, p. 243.)

In cases of more protracted, but still simple continued fever, the early phenomena are similar to the shorter cases, and the protraction is mainly due to the slowness of the defervescence—an example of *lysis*. The phenomena of such defervescence, as indicated by the range of temperature, are indicated in the following diagram.

As a rule these fevers are not serious; but the degree of re-action has always a relation to the state of the constitution, whether sthenic or not (MOREHEAD).

TYPICAL RANGE OF TEMPERATURE IN A CASE OF PROTRACTED BUT SIMPLE CONTINUED FEVER (*ephemera protracta*). THE RECORDS INDICATE MORNING (M.) AND EVENING (E.) OBSERVATIONS (Wunderlich).



There are not a few physicians who doubt the occurrence of *simple continued fever* as distinct from the continued fevers already described. On the other hand, there can be no doubt that cases of an anomalous or mixed nature do sometimes occur, concerning which a decided diagnosis cannot be given from the general symptoms merely; and the term *common or simple continued fever* "has become a refuge for many cases of an uncertain character."

But while these four distinct forms of continued fever are capable of being recognized, there can be no doubt that cases of fever do sometimes occur in this country, which run a continuous course, and which, in many respects, do not seem quite the same as those with which we are now familiar, and which cannot at once be clinically recognized. For instance, in the very interesting investigation into the nature of "*typhus* and *typhoid fever*," by Dr. Murchison, recorded in the forty-first volume of the *Medico-Chirurgical Transactions*, it is related that about 200 cases are left out of consideration altogether, because they were "doubtful cases," and could not be classed as either *typhus* or *typhoid* cases.

A similar class of "doubtful cases" are seen to occur in places where *yellow fever* and *remittent* fevers occur, and which cannot be classed as either the one or the other form of fever.

Again, in the Mediterranean latitudes there is a "gastric remittent" fever described, which seems to have some characters in common with some of the forms of continued fever (CRAIGIE, MARSTON).

Wunderlich and Murchison both describe febrile phenomena, which are of so anomalous a kind that they refer them to a combination of the poisons of typhus and typhoid fevers, so that the characters of each do not remain distinctive. So also Dr. W. T. Gairdner, in stating that of late (from 1853 till 1862) the cases of fever in the Edinburgh Royal Infirmary have not been more than seven or eight cases a-month under his notice—including *numerous anomalous fevers* which have prevailed, and which have sometimes quite overborne the numbers of genuine *typhus* and of *enteric* fever together (*Clinical Medicine*, p. 154). A fever termed "*gastric*" is distinctly described by Dr. Andrew Anderson, of Glasgow, which would also come under this head. The "*bilious remittent*," or "*bilious typhoid*," of Griesinger, of Tubingen, is another form of continued fever which requires investigation. He observed it at Damietta in Egypt. It is probably a malarious fever of a remittent type, or some form of yellow fever. The sudden fall of the pulse from 120 to 75 was not attended by corresponding improvement of the patient, but was the forerunner of severe typhoid symptoms and jaundice. The mortality was equal to 19 per cent.; and quinine was found to be of signal service (MURCHISON).

The works of Morehead and Sir Ranald Martin may also be referred to for various anomalous forms of continued fever; and in which the "ardent continued fever" of India may be quoted as an example of a very serious disease. For an account of this fever the reader is referred to page 164 of Dr. Morehead's work, and page 204 of Sir Ranald Martin's.

It is these "doubtful or anomalous" cases especially which require careful and special methods of investigation. They are of the utmost importance to science, for more extended information regarding them will either connect them with forms of fever between which they seem to stand; or these "doubtful cases" will eventually separate themselves into distinct forms whose history

is still unknown. In such doubtful cases observations regarding the co-relation of temperature, the excretions, the succession of phenomena, and general course of the disease, are imperatively demanded.

The poisons of tropical fevers especially require to be carefully studied, and the phenomena of the febrile state which accompanies them embrace some medical problems of the most abstruse nature. Physiological data of an exact kind are now beginning to rise around us, which will give a standpoint for comparison in the study of the phenomena of fever in the tropics. Extremely important observations are being worked out by Dr. Emile Becher of the Army Medical Department in India, regarding the influence of tropical climate on the excretions of the urine in relation to the body weight. At great personal sacrifice and denial of self, he has twice undertaken such investigations on his own person in voyages to India, round the Cape of Good Hope. With all such exact information, and the improved physical aids to investigation, it behoves the physician and pathologist to investigate medical problems with the same logical rigour and severity as a chemical or an astronomical theorem demands. On this important point the opinion of one may be especially quoted, whose experience as a teacher of clinical medicine has been great, and whose philosophical investigations into the nature of fever, in particular, commands the respect of all. On this point Dr. Parkes thus writes,—“The power of observation in medicine is a kind of tact which ought to be cultivated with the same assiduity as the chemist practises when he learns how to manage his delicate manipulations, or the astronomer when he wields his wondrous tube. In medicine the observation and recording of phenomena has been held to be an easy and trifling task, which any tyro was competent to do. Hence half the error and uncertainty of medicine. Inaccurate, that is, erroneous and incomplete observation, has been the cause that, till within these few years, the fevers of cold countries have been so absolutely uncomprehended, and that the fevers of hot countries are still shrouded in obscurity. The most valuable addition any one could at present make to our knowledge of tropical fevers would be a simple record of all the cases in an epidemic. These cases should be observed with the keen tact of a Chomel and recorded with the fidelity of a Louis. We want no explana-

A similar class of "doubtful cases" ; we want merely the where *yellow fever* and *remittent fever* are sufficient, we should be classed as either the one or the other of this chaos. And let not any

Again, in the Mediterranean localities be deterred from the task, remittent" fever describe" say to say, most reprehensible argu-acters in common with people may favour him,—viz., that his (CRAIGIE, MARSTON)

Wunderlich and by some of the profession who consider their which are of great an effort as their intellect will bear; but bination of we will venture to say, they will be by those character and and we think no labour too great if they can fix safely the founda-Gairdner of medicine, and for whom, if accurately reported, no cases fev be too long, no observations too minute. Only, before the t' task is commenced, let the observer feel that his powers are equal to it; and let him bear in mind the example of Louis, who recorded most carefully for a long time, that he might train himself to this duty, and then, throwing his probationary cases aside as too uncertain for use, began to make those remarkable series of observations which have linked his name for ever with the greatest improvements in modern medicine—the employment of a correct method of studying his science." (*B. and F. Med.-Ch. Rev.*, Oct., 1850, p. 435.)

Treatment of Febricula.—Such means as an emetic, purgatives, tepid sponging, diaphoretics, and antiphlogistic regimen are to be employed. In plethoric individuals, where there is much headache and flushing of the face, a moderate general blood-letting, or leeches to the temples, may be expedient, but they are not often necessary (MOREHEAD).

SPECIFIC YELLOW FEVER—*Febris Icterodes*.

Definition.—A specific fever of a continuous type, occurring, as a rule, only once during life, and propagated by contagion. It is attended by yellowness of the conjunctivæ and skin, delirium, suppression of urine, black vomit, black stools, a slow and, at times, an intermittent pulse. It is limited to very definite geographical limits, never appearing beyond 48° north latitude, nor without a temperature of 72° Fahr. at least, which promotes its propagation. It has occurred as high as 4,000 feet above the sea-level (Newcastle, in Jamaica). But, as a rule, it is endemic

in low districts on the sea-coast, and rarely occurs above an elevation of 2,500 feet above the level of the sea.

Pathology and Symptoms.—By some Yellow Fever is considered *one sui generis*, and specifically different from remittent and intermittent fevers, or any other form of malarious fever (CULLEN, OLME, BLANE, WOOD). Others there are who believe that these fevers are the same in kind, but various in degree; that under certain atmospheric conditions, such as great heat or humidity, acting on a predisposed frame, will produce all the symptoms of the most malignant fever; that the intensest form of yellow fever is but the developed degree of the common bilious derangements peculiar to hot and rainy seasons (TOMMASSINI, CLEGHORN, LIND, HUNTER, ALISON, CRAIGIE, MARTIN). It has been held also that a specific non-contagious agent produces a fever which has been called “yellow;” but which is totally different from the real yellow fever (ROCHOUX). On looking carefully into the history of yellow fever, on which volumes have been written, the conclusion arrived at seems to be,—(1.) That there is a specific yellow fever, propagated by a contagious virus or poison, which multiplies itself by its passage through the human system, and which reproduces the same specific true yellow fever. The type of this fever is continuous. Pyrexia, delirium, suppression of urine, black vomit, are the leading symptoms of this fever—the *hæmagastric pestilence*, as it has been also called. (2.) That there are other fevers, and especially severe marsh fevers, in certain geographical limits, which have a close resemblance in symptoms to the contagious and specific yellow fever. So also, it is said, there are fevers arising simply from a high temperature acting on an unseasoned subject. On this point my friend and colleague, Dr. Maclean, Professor of Military Medicine, writes me as follows:—

“I am now myself a firm convert to the doctrine that yellow fever is specifically distinct from remittent. To this opinion I have come with a full knowledge of the fact that some cases of remittent fever in India closely resemble some of the forms of yellow fever. But of this I am now certain, that the yellow fever of the true yellow fever zone is unknown in India, where true malarial fevers abound. There is in true yellow fever, for the most part, an absence of that periodicity which is an unfailing characteristic of true malarial fevers. Then there is the difference so well insisted upon by Blair in true malarial fevers. Men do

not pass from recovery to health, as is the case in such a marked degree in yellow fever, after which there is no, or very little, evidence of the existence of any cachexy. Malarial fevers exist and are destructive at a temperature at which yellow is at once destroyed. Albuminous urine is almost invariable in yellow fever—only occasional in remittent. There is in yellow fever an unexampled range of hæmorrhages; in remittent fever these hæmorrhages are often, indeed generally, absent. Quinine has a power over malarial fevers that is beyond the reach of doubt or cavil; the same is not true of yellow fever. Men suffer from malarial fevers again and again; second attacks of yellow fever are, to say the least, rare."

Considering true yellow fever, therefore, as one of the specific continued fevers, having a certain limited geographical range, it is necessary at the outset to define what is meant by true or pestilential yellow fever, and what are the diagnostic symptoms which distinguish it from the diseases which resemble it; but which are really dissimilar.

It may be asserted unconditionally at the outset, that the significance of the symptoms of yellowness of the skin and black vomit is very small indeed as diagnostic marks. Different shades of yellowness of the skin have been described as forming a prominent symptom, not only in epidemics of yellow fever, but by all writers on the fevers generally of hot countries. Yellowness of the skin in remittent fevers, arising from malaria, has been noticed in all climates, although it is certainly most common in those of the Western hemisphere. Cleghorn observed it at Minorca; Irvine in Sicily, in the autumnal fevers; Burnett in the Mediterranean fevers, of all depths of colours. In the fatal fever of the Mysore country yellowness during some years has been almost universal; so also in Batavia and in the fevers of Rangoon in 1824-5. A fever, attended with yellowness of the skin, raged like a pestilence in Rohilcund from 1836 till 1840, at the same time that a fever, with symptoms of plague, was prevalent in Marwar and Meywar, and common remittents and intermittents prevailed between these districts. A fatal remittent fever attacked Her Majesty's 29th regiment in 1844 at Ghazepore. In many cases there was "deep jaundice;" and in one case a symptom occurred which has been often witnessed in the West Indies, namely, sloughing of the penis and scrotum. (Parkes "On the Contagion of Yellow Fever" in *B. and F. Med.-Ch. Rev.*, Jan.,

1848.) So also in some forms of yellow fever, as in the *algid* form, so well described by Dr. Lyons, in the Lisbon epidemic of 1757, yellowness was very often wanting, "many cases dying without having ever exhibited a trace of yellowness on any part of the cutaneous surface or even the conjunctivæ during life" (Lyons *On Fever*, p. 338.)

Black vomit is an event which occurs in fevers of marshy origin, and in the so-called "seasoning fevers," as well as in gastric affections of a purely tropical nature, in *coup de soleil*, and in some injuries of the brain. In the remittent fevers of the African stations black vomit is not an unusual occurrence. So also in some of the yellow fevers of America, which are of marshy origin, black vomit is a usual symptom (BOOTT.)

These two events, namely, yellowness of the skin and black vomit, being of themselves insufficient as diagnostic marks of true or specific yellow fever, additional grounds of difference are found,—(1.) In the type of the fever which is continuous, and not remittent; (2.) In the fact that it occurs, as a rule, only once during life; (3.) In the fact that it is propagated by contagion. But although in no one of these phenomena, taken singly, except in that of contagion, do we find any definite characters to rely upon to prove the existence of a formal and specific yellow fever, yet, in the general assemblage and collocation of symptoms, peculiarities do present themselves which are easily discernible by an experienced eye.

The account given of yellow fever in the previous edition is founded on too limited information; and a more extended study of the subject leads me to retract much of what I had previously written on the subject. And although the subject of tropical fevers is too little known to warrant decided opinions on many points, yet the true yellow fever, or hæmagastric pestilence, is now so clearly stamped with characters so peculiarly their own, that it takes its place as a specific fever of a continuous and generally rapidly fatal type. Its pathology is best exemplified in the history of such isolated outbreaks of it as are to be found in the cases of the "Hussar" (BLANE), the "Bann," the "Kent," the "Scout," the "Eclair," the "Hankey," and the "Icarus;" and no description of yellow fever can be complete which does not give an account of some of these remarkable instances of this disease.

The case of the "Eclair" may be selected in illustration. The

"Eclair" steamer was commissioned in August, 1844, and sailed for the west coast of Africa in November of the same year. From 8th December to 4th July, 1845, she was employed in watching for slavers off Sherbro and Seabar, and she also visited Sierra Leone. Up to 2d March, 1845, the health of the crew continued good; but after this time she sent her boats up the Sherbro and Seabar rivers, and remained at anchor from six to three miles off the shore. From the 3d of April till the 10th of June, 1845, she had thirteen cases of fever, of which ten were fatal. With two exceptions, these all occurred in men who had been employed in the boats. On 4th July, 1845, the "Eclair" arrived at Sierra Leone, and at this time the health of the crew was improving. The men had limited leave, but several of them slept on shore. They were also employed in cleaning out the "Albert," which had remained untouched since the Niger expedition. On the 23d of July she left Sierra Leone, and anchored off the coast till 9th August. During this time there were fifteen cases of fever and six deaths. On the 9th of August the steamer arrived at Gambia, and left on the 15th; on the 16th she arrived at Goree, and was refused pratique. On the 21st of August she arrived at the island of Boà Vista, one of the Cape de Verde islands, and at this time there were only five cases of fever on board. The numbers increased, however, so rapidly that, on the 31st of August, the crew were landed on a small island two miles from Porto Sal Rey, the capital of Boà Vista. The mortality being increased instead of diminished by this measure, the crew re-embarked on the 13th of September, and steamed for England, where the ship arrived on the 28th of September, and was put in quarantine. During this run there were forty-one new cases and twelve deaths. After her arrival at the Motherbank there were nine fresh cases and four deaths. An analysis of all the circumstances connected with the "Eclair" shows (1.) That the immediate consequences of landing the crew at Boà Vista were a thorough intercourse with the inhabitants, and the communication to them of the same fever with which the "Eclair" was infested. For some time before the arrival of the "Eclair" it is certain that the island of Boà Vista was perfectly healthy; and this was true also of all the other islands of the group (ALMEIDA, MACWILLIAM). So great, also, was the dread of the disease among the inhabitants that the consul had great difficulty in procuring labourers; nevertheless,

the crew managed to smuggle vast quantities of spirits, and, of course, it is possible that more secret intercourse went on than can be gathered from any official reports. Certain of the inhabitants were also brought more or less in contact with the crew of the

Eclair." There were—1st. The military guard at the Fort; 2nd. The labourers employed on board the "Eclair"—forty-one in number; 3rd. The labourers employed in the launches, or at a coal-heap on a small island—forty-six in number; 4th. Washer-women who washed the officers' clothes—seventeen in number. In addition to these, Captain Estcourt, the commander of the steamer, lived at the consul's house; the gun-room and ward-room officers, and midshipmen, occupied a house in Porto Sal Rey; and leave was given to the warrant officers and a few of the men, one of whom stopped in the town for two nights. The "Eclair" left on the 13th of September; on the 14th or 17th a corporal of the guard was taken ill; on the 15th or 18th a private; and in both cases the symptoms were fever, wildness, and constant black vomiting. The corporal died on the 17th or 20th, and the private on the following day. Others of the guard were taken ill, and being conveyed into the town, the introduction of the fever amongst the inhabitants is attributed to them. It also appears (2.) That the men who were chiefly in contact with the crew and with the sick men, and who were in the sick men's apartments, suffered much more severely than any other class; (3.) That the propagation of the fever appears to have been strictly in proportion to the amount of intercourse; (4.) That within a reasonable time after the departure of the "Eclair" there were three persons ill with fever at Boà Vista, and two already dead; all of whom had been in contact with the crew of the steamer.

The period of incubation of the fever at Boà Vista was found to vary from two to eight days; and the facts recorded in the history of the spread of the fever over the island show that certain persons living nearest and most in contact with the two sick soldiers were first attacked. When the disease appeared with great virulence in the island of Granada in 1793, its spread by infection first attracted notice by the arrival of the "Hanky" from Bulam, on the west coast of Africa, on the 19th February, 1793, some days before the fever broke out on the island. In this vessel, at Bulam, the fever had prevailed for five months before to a great and fatal extent (CHISHOLM, SIR WM. PYM).

The history of the fever on board His Majesty's ship "Bann," and the propagation of the fever to the inhabitants of the Island of Ascension in 1823, recorded by Sir William Burnett, is almost precisely similar to that of the "Eclair;" and if these cases be taken together, agreeing, as they do, in all their main features, it is impossible to doubt the existence of a multiplying or contagious virus as the specific cause of yellow fever.

Symptoms.—The following account of the symptoms are chiefly taken from the observations of Sir Ranald Martin and Dr. Blair, and are intended to embrace the slighter, the severer, and the more fatal seizures. Like cholera, it is ushered in suddenly, and generally in the night, or early morning, by a sense of coldness, a rigor, or actual shivering, followed by a vascular re-action proportionate to the amount and duration of the previous congestive cold stage. Heat and dryness of the skin follow, with pain of the loins and limbs, headache and pain of the eye balls, which are suffused and of a gloomy drunken-like aspect. The tongue is loaded and the edges red. The headache is generally supraorbital, and is a valuable diagnostic symptom in old residents and dark races. There is also to be observed a *specific capillary irritation* in the flush of the face, as characteristic as the hectic of phthisis, or the fuliginous expression of typhus. This suffusion generally occupies a zone over the eyes, and about an inch above and below them. The eyes become injected like those of a person *just awoke*, but generally without any lachrymation or photophobia, although the injection may be as intense as in ophthalmia. The nails may also be observed to be injected, with a coarse vascularity, the lips crimson or vermillion colour, the tongue scarlet at the tip and edges, the fauces, palate, and uvula covered and connected with a reticular network of capillaries. There is also nausea, with a sense of rawness of the fauces and œsophagus, and uneasiness at the epigastrium. This sense of nausea, and a disposition to vomit, is generally induced by pressing down the tongue previous to any examination of the fauces. These symptoms may terminate in health as a remittent fever would at the end of twenty-four or thirty-six hours. If the disease proves persistent, these symptoms continue and become aggravated, and the ejections from the stomach, at first of a clear fluid, soon become dirty brown, and eventually are succeeded by the true *black vomit*. The complexion now becomes more or less generally of a lemon-yellow

colour, and this colour extends rapidly over the whole surface of the body. These symptoms progress from bad to worse. A bloated, desponding, anxious inquiring countenance expresses the distress of the patient, combined with incessant and distressing jactitation, which ends rapidly in exhaustion and death. In youthful or plethoric Europeans the symptoms are of exceeding violence and danger. The heat is of a burning pungency, while the skin is dry and constricted, the headache is intense, the countenance appears to be agitated by the most fearful apprehension, or approaching delirium. The bowels are constipated. The tongue is red, clean, and tremulous, and indicates increase of gastric and intestinal irritation, and consequent increase of danger. The urine is scanty and surcharged, and ultimately all the secretions are suppressed. There is distension of both hypochondria, with pain and burning heat, and anguish at the epigastrium. Eructations, hiccough, and vomiting continue, at first of a clear glairy fluid, which alters to a brown or dark colour, like coffee grounds, and the quantity ejected exceeds greatly that which has been used in drink. In persons of a sanguine complexion the countenance is apt to assume a livid, yellow, putrid-like appearance, with a black encrusted tongue, and in most cases the whole of the surface of the body becomes more or less yellow, which indicates the most severe form of the malady, and the patient may be carried off, exhausted in all his functions, so early as the second, but more generally on the third day. "Cases of long standing chronic disease," says Dr. Blair, writing of the epidemic of British Guiana, "terminated suddenly and fatally by the black vomit, without any precursory fever, to the surprise and consternation of the bystanders." At Gibraltar the patients died without taking to their beds, or "on foot," as it was termed. The following case is given by Louis:—Dr. Matthias, who died at Gibraltar after an illness of four or five days, experienced no other symptoms than severe pains in the calves of the legs, and a suppression of urine. He had no nausea, and did not vomit, and his mind was clear during the whole course of the disease. He noticed, however, the suppression of urine, dictated three or four letters to a friend, begged him to write rapidly the last, that he might sign it, then devoted a short time to an affectionate intercourse with this friend, and soon after, becoming speechless, he thanked him by a sign, and in a quarter of an hour was dead

Sometimes the full complement of standard symptoms are present, sometimes they are imperfect and deficient, and sometimes displaced. At one time the diagnostic symptom in an epidemic is the supraorbital headache. At other times the tongue symptoms are alone diagnostic, or their equivalents are expressed in the uvula and fauces. Intense surface heat, albumen early in the urine, and early black vomit, are among the later symptoms; and smoky pale urine, with perfect blood corpuscles, take the place of the straw-coloured or bilious urine, with its sediment of tube casts and epithelial matter.

The general appearance of the tongue is uniform redness of the tip and edges together, which are always clean. Subsequently the fur separates from its middle surface, and lies in white wavy flakes; and the next series of changes consists in separation of the epithelium, which begins at the tip, and proceeds to the edges down the raphe, and may continue till the whole surface is denuded, the papillæ obliterated, and the tongue becomes smooth and dryish, and of the colour and appearance of raw beef. Such a desquamation may extend into the larynx and bronchi, causing complete aphonia, and sonorous dry sounds under the stethoscope.

A rare manifestation of capillary irritation in yellow fever consists in an efflorescence of the skin in the form of a subcutaneous rash on the chest, and extending over the abdomen and arms. On fine delicate sensitive skins rose-coloured spots have been noticed, of a somewhat circular shape, varying from the size of a flea-bite to what might be covered with the point of the finger. They result generally from mosquito wounds, and become hæmorrhagic at the end of the disease, when it terminates fatally.

Bloody furuncles appear late in the order of symptoms, and are to be regarded rather as sequelæ. Their most common site is on the wrist, over the metacarpal joints, along the front of the legs, below the scapulæ and over the hip, in the parotid region, and over the forehead and lip. They are generally in close proximity to the smaller arterial branches, such as the ulnar, radial, anterior tibial, gluteal, intercostal, and facial arteries. They become tender, acuminate, and inflamed, and sometimes form large abscesses of purulent matter, with a pale or inflamed surface, and this chiefly when below the scapula or over the hip. Generally on the legs they are flat, present no inflamed appearance, but show a flat, purplish vesication, about the size of a split pea or a sixpence.

"If you open one of these vesications," continues Dr. Blair, "a little watery, curdy sanies will be discharged; and you will believe that that is all, and of no consequence. But if you clip away this vesicle, and wipe the bare cutis, you will perceive in the centre of it a circular perforation, into which a probe easily passes, and which goes down through the true skin to the surface of the deep fascia or the muscle. And if you now squeeze on each side of the vesication, one or two little dark clots or pellets will start up, and be accompanied or followed by a little purulent matter. There is no base or hardness; there seems to be no cyst; and the whole will close up and heal, and require no further treatment. This is the simplest form of that morbid manifestation; but when it occurs over a joint, or below a strong confined fascia, abscess, with diffuse phlegmonous inflammation—or in a vascular tissue, as the parotid gland, death from destructive infiltration of blood, gangrene, and hæmorrhage—may follow. The formation of these bloody furuncles, it is probable, is not confined to the external parts of the body. *Post-mortem* examination, in one case, disclosed a condition of the kidney which was probably due to this cause."

There is great irregularity in the temperature of the surface. Sometimes the forehead is the hottest part of the body, occasionally it is the chest. The uncovered parts, in the latter stages of the disease, are easily reduced in temperature, and thus, while the exposed chest and extremities may feel cool to the touch, the axilla may raise the thermometer to 102° or 103° Fahr. The highest temperature Dr. Blair has observed was 107° in the axilla.

Observations made on the urine, in yellow fever, by Dr. Blair, show that it is always acid in the first stage, and continues so generally till convalescence, when it becomes alkaline, or until it becomes heavily charged with bile. During the early stage the urine is normal in colour, clearness, and quantity. About the third day the colour alters, and becomes of a sulphur, primrose, straw, or light gamboge hue, perhaps slightly turbid, and with a little floating sediment. The colour deepens till it becomes yellow or orange; and if the case ends in convalescence, the urine is copious and may appear black. Sometimes the urine has a pale, watery, smoky appearance, with a layer of blood corpuscles in the sediment, and sometimes it is very bloody.

Albumen appears on the second or third day generally; in

some cases as early as the first day; and in a few cases it did not appear till the day of death, and after black vomit had set in. Albumen appeared in every fatal case of normal duration. It sometimes ceased suddenly in convalescence, and always before the yellow suffusion of skin and eye, or bile in the urine, had disappeared. Between the eleventh and twentieth day of grave cases it generally disappeared. Its colour was never white. When the urine appeared turbid, it was due to the presence of mucous epithelial matter, coagulated albumen, coats of the urinary tubuli, or fine capillaries of the kidney or mucous membrane passed out with the urine. The tube casts are generally short, thick, club-shaped, and opaque, attended with large organic cells and epithelial scales. Crystalline deposits are rare. In females the catamenia are sure to appear, whether due or not. No sign is so dooming as a suppression of urine, *black vomit* not excepted. The alvine evacuations may be black towards the close of the disease, or very dark green, and bilious; but after the black stools have ceased, they are succeeded by evacuations which resemble fine, dark, sandy mud, and named the "caddy stool." As the disease still further advanced, and towards its fatal termination, the dejections again changed their character. They became scanty and mucous, of various consistence and colour. These mucous stools almost always appeared *after* black vomit, and were contemporaneous with the scanty urine before described. The alvine evacuations in yellow fever, from the beginning to the end of the attack, are always alkaline, except in one instance, that of the black vomit stool: in that it is always acid. Its chemical quality is evidently due to the admixture of a portion of the black vomit, which has descended (if not found in the intestines) by peristaltic motion into the intestines, and mixed with the scanty mucous stool, and in such quantity as not only to neutralize it, but to be in excess. The scanty thick mucous stool—almost a jelly—has generally a little thin serum around it in the bottom of the pot. The bulk of all these varieties of the scanty mucous stool consists of mucus, broken-up epithelial matter, and myriads of epithelial granules. Sometimes little wavy flakes, like morsels of cuticle, are also to be found. They also frequently contain the crystalline bodies of the caddy stool, particularly when they are rather thin and serous. By appearance, they would be taken for rectal stools,

and the results of tenesmus; but such is not the case. A burning sensation is often complained of, but seldom any tenesmus, and no doubt these stools consist of that mucous matter which we find after death lining the intestinal canal generally. In a few cases where there has been total suppression of urine, these stools have become diarrhoeal.

The first ejections from the stomach of a yellow fever patient are seldom seen by the physician. Mucus and bile soon appear, occasionally with a streak or speck of blood, and with violent retching. The ejections are alkaline. Generally after the first vomiting the stomach becomes tolerably settled, until the second stage sets in, on the second, third, or fourth, or as late as the fifth day of the disease. Then, without warning or nausea, but on any trifling provocative, the stomach suddenly ejects a quantity of clear, pale, limpid, or slightly opalescent *acid fluid*—the *white vomit*, which indicates the beginning of the stage of acid elimination, and is generally coterminous with the first shedding of epithelium from the tongue. Sometimes the evacuation of this vomit has a critical effect, equivalent to the perspiration of intermittent fever. True white vomit consists of serum, more or less acid, which remains clear on the application of heat and nitric acid.

The transition of symptoms from *white* to *black vomit* is generally gradual; and is attended with a "suspicious sediment" of "snuff-like specks" before it merges into well-defined *black vomit*. The stage of acid elimination continues to the close of the disease, and is most intensely manifested during the production of the *black vomit*. The presence of ammonia in black vomit is universal, and may be considered as one of its tests; and its specific gravity 1.004 to 1.006, the temperature of the air being 86°. Its sediment consists of coagulated albumen and the debris of blood cells. Another test is acidity, and a third is to be observed in the phenomenon that the sediment is dissolved by liquor potassæ, which disengages ammonia.

Another feature in the pathological symptoms of yellow fever may be expressed by the fact that the urea of the suppressed urine is eliminated from the system as a volatile salt by metamorphosis into a carbonate of ammonia, which as such is frequently found in the breath, in the normal black vomit, in combination with an acid, almost always in the stool, and apparently pervading all the tissues of the body.

After convalescence recovery is rapid and thorough, but relapses are of frequent occurrence, especially after primary attacks not well expressed (and to which Dr. Blair gives the name of "aborted attacks"); but they are rare after the disease passes into its second stage.

The mode of death may be by syncope, uræmia, apoplexy, or asphyxia.

Uniformity in the order and character of the symptoms must not be looked for in yellow fever. All the best writers on the subject, whether recording their experience in the West Indies, the west coast of Africa, or the south coast of Spain, are uniform and unanimous to the contrary, and consequently while direct and faithful descriptions may have been given of each epidemic, yet the results are not general nor uniform. Certain symptoms in certain epidemics vary in their nature and in the time of their accession, while others, common to former visitations, are wanting in those which follow. Hence two, three, or even four forms or types of yellow fever have been described by authors. These have been very clearly defined by my friend Dr. Lyons, of Dublin, in the Lisbon epidemic of 1857, which he investigated with so much care and enthusiasm.

The *types, groups, or forms* which he found capable of clinical recognition are,—(1.) The algid form; (2.) The sthenic form; (3.) The hæmorrhagic form; (4.) The purpuric form; (5.) The typhous form.

The first of these, namely, the algid form, is that which presents the most rapid course, the earliest and greatest amount of prostration of the vital powers. These are the cases which are suddenly killed with the poison. "The patient, while in the enjoyment of his usual health, and in the midst of his usual occupation, feels suddenly the effects, as it were, of a sudden blow from a heavy bar on the back, falls down while walking (or if standing), and dies within a few hours in profound collapse, and after exhibiting more or less of the other symptoms of this fever." The countenance became sunken, the eye dull and filmy, the surface cold, and the patient felt cold, depressed, and wretched. The face became of a dirty livid hue, and this appearance extended to the trunk and limbs, the surface then presenting innumerable points of minute venous congestion, and sometimes purpuric spots and patches of various sizes. In extreme cases

the lips, the breath, and tongue were cold, with a temperature in the axilla not more than 96°, the pulse being small, feeble, and quick; and when the cardiac action became feeble the radial pulse would be obliterated.


The *sthenic form* is a marked contrast to the *algid*. It is especially well marked in both sexes at the prime of life, and in persons with well-developed muscular frames. Such cases are characterized by well-marked febrile symptoms, severe and persistent headache, much rachalgia at the outset, a high, full, and hard pulse, occasionally thrilling and resisting, with flushed face and throbbing temples. A remarkable elevation of temperature prevailed,—an increase of 3°, 4°, or even 5° Fahr., and in some an increase of 7° Fahr. was observed. Death sometimes took place in a very unexpected manner.

In the *hæmorrhagic type* the cases are the most characteristic and appalling. In them epigastric anxiety, with or without heat, and pain on pressure in the epigastrium, is well marked; but their great characteristic is a tendency to profuse simultaneous effusions of blood from various parts and organs—the *hæmorrhage never being single, nor from any one source or organ only*. The cases are fatal at an early period; and all the connective tissue of the body is surcharged with blood. There is less considerable elevation of temperature than in the *sthenic form*.

In the *purpuric form* the pyrexial state is well marked, with the conjunctivæ and general surface intensely yellow. Purpuric patches commence and spread—sometimes with surrounding œdema. These patches are manifestly caused by subcutaneous effusions of the colouring matter of the blood; and all varieties and shades of colour and tints are observable.

In the *typhous form* two orders of phenomena may prevail. In one class of cases stupor and nervous depression exist from an early period of the fever, with all the other well-marked and characteristic *typhoid* symptoms; and to these are superadded the hæmorrhagic phenomena. In another class of these cases the patient, after passing through the *sthenic* or the *algid form*, would insensibly glide into the *typhoid state*, on the cessation of the hæmorrhages (LYONS).

It is of great importance to attend specially to the study of these forms or types; for, as Dr. Lyons justly observes, much of the discrepancy and apparent conflict of medical testimony on the



subject of yellow fever is due to the want of discrimination of those leading characteristics and salient features (LYONS, l c., p. 375).

When the black vomit is plentiful, or the urine free, the intelligence remains clear and unclouded, but the skin becomes cold and damp, the pulse small, and finally extinct at the wrist, and the patient dies of gradual *exhaustion* and *syncope*.

A melancholy instance of the combination of hæmorrhage and black vomit in tending to induce death by syncope, is thus pathetically described by Dr. Blair:—

“Before black vomit appeared, the catamenia came on prematurely, the bowels became spontaneously relaxed; and last night there was much flatulent purging of blood, and a considerable hæmorrhage from vagina. After a cessation of twenty hours, black vomit again returned. After total suppression for twenty-four hours, four ounces of alkaline urine was drawn off by catheter. On my visit at daylight this morning she was quiet, and apparently suffering no pain, and rather apathetic. The marked change which I found in her case was a deterioration of the pulse in volume. The nervous symptoms of the preceding day, which threatened inebriation or convulsions, had disappeared. The pulse became gradually weaker, until about eleven A.M., when it could not be felt. She was aware of her hopeless condition, and tranquilly disposed of her trinkets to her friends and relations. As she approached her end the breathing became quicker and shorter, until it ceased in a few little gasps at long intervals. About half an hour before she died she apparently lost her vision, then her hearing and sensation, first of the mouth and nose, and then of the arm, in quick succession, and in the order stated. It was an appalling scene to see her lying silently on her back, and trying to *rub back* vision, and hearing, and feeling, with her hands. She spoke not a word during the time; but it was evident that the senses were all being blotted out one by one while consciousness yet remained. Before death, at two P.M., one or two slight convulsive jerks of the shoulder were the last respiratory efforts.”

If before death the urine be suppressed, and the black vomit not copious or has ceased, the circulation becomes contaminated, and the subsequent effects upon the brain are not unlike those of alcoholic inebriation, when poisoning symptoms become violent, the sensorium painfully affected, screams and wild ravings ensue, soon followed by coma, convulsions, and death.

Prognosis.—Dr. Blair founds his prognosis on the following

grounds:—"The number of the characteristic symptoms present, and the degree in which they are manifested, furnish criteria of the severity of the case and the ratio of danger. A slow pulse and moderate temperature of the body and quiet stomach are always favourable indications. But the more fiery crimson the tip and edge of the tongue, the more irritable the stomach, the severer the headache, the worse the prognosis of the first stage, and *vice versâ*. Slight or moderate epistaxis is a sign of little prognostic value in any stage; but a streak of blood in the early vomit indicates much danger from the attack; while the same during the stage of black vomit, or after acid elimination has set in, is favourable, if the corpuscles are found entire. In the second stage the earlier or more complete the suppression of urine and the more copious the ejections of black vomit, the more imminent the danger. But if the urinary secretion continue, and the black vomit be scanty from the first, or is afterwards suppressed, the patient may yet survive. Urine simply albuminous is a less serious sign than when it also contains tube casts; but if these are thin and few in number they do not add much to the gravity of the indication. Free, copious urine, no matter how dark or bilious, is the most favourable of any single sign. If the urine be scanty, and it be loaded with tube casts, entangled in epithelial and coagulable matter, the light buff-coloured curdy sediment before mentioned, it indicates a complex lesion of the secreting structure of the kidney. It is the urine symptom in its maximum of severity, and is as fatal as if the suppression had already occurred. Blood corpuscles in the urine were not looked on with apprehension. A faltering of the articulation is a bad prognostic, and a difficulty of protruding the tongue enhances it. Prognostics are derived from the effects of treatment. If the resolvent dose do not bring away 'stools characteristic of the powder' (calomel), but, instead, thin, grey abilious matter; or if early hypercinchonism be induced, it is an unfavourable indication. The danger of the case is enhanced by inflammatory complications, and by hypertrophy of the heart. A recent residence in a temperate climate; the *race* or complexion of the individual; the fact of his previously having suffered from an attack, will enter into an estimate of his chances of recovery. It is unnecessary to recapitulate the modes of death. These are signs too late to be of any practical importance."

Prognosis is declared by Robert Jackson to be treacherous and difficult in the extreme. As last seen by him on the south coast of Spain, he records the following symptoms as indicating danger:—

1. Sudden invasion, with intense pain of the head and eye-balls, sickness, and vomiting.

2. When convulsions, apoplectic stupor, or outrageous delirium usher in the fever.

3. A torpid, heavy, or statue-like aspect of the countenance.

4. A dry, rough, and milk-white, or swollen and red tongue.

5. Distress and anguish, with pain at the epigastrium, forcible eructations, or explosions of flatus from the stomach, or obscure hiccough.

6. A ghastly appearance, with a faint nauseous odour from the body.

7. Yellowness of the skin, with turgid veins of the conjunctivæ in the latter stage.

8. Torpor of the skin, and insensibility to irritants.

9. Extreme dampness or extreme dryness of the skin, petechiæ, streaks or patches of a livid or green colour.

10. Vomiting of black matter, or dejections of black watery stools with shreds.

The mortality from intermittent, remittent, and yellow fever, according to the reports of the sickness and mortality occurring among the troops in the West Indies, the Mediterranean, and in North America, by Sir Alexander Tulloch, is as follows:—

Deaths from	Windward and Leeward Command.	Jamaica Command.	Gibraltar.	Malta.	Ionian Islands.	Upper Canada.	Lower Canada.
Intermittent fever,	1 in 169	1 in 163	1 in 60	1 in 311	1 in 236	1 in 1143	1 in 535
Remittent fever,...	1 in 9	1 in 8	1 in 11	1 in 24	1 in 22	1 in 11	1 in 5
Yellow fever,.....	1 in 2½	1 in 1½	1 in 1½	—	—	—	—

Treatment.—With some practitioners, “the prime object of treatment is to *abort the attack* ;” an early attention to first symptoms among the susceptible is of the greatest value in saving human life.

The medicine used to procure abortion of the fever consists of *twenty grains of calomel*, added to *twenty-four grains of quinine*, and afterwards followed by *two drachms of carbonate of magnesia* to *two ounces of sulphate of magnesia*, in eight ounces of pepper-

mint water" (DR. BLAIR). These aborting doses were repeated at intervals of four or six hours; one dose being generally efficient; but four doses have been given before the desired effect has been produced, without inducing cinchonism. When a state of apyrexia is induced, the end is attained; but if the urine has become coagulable, or the epithelium of the tongue has begun to be shed, it is of no use pushing the "aborting doses" farther.

Such are the opinions of Dr. Blair, who believes that thus the fever may be cut short; but the diagnosis of such cases may be questioned, and such a belief is opposed to the doctrines of sound pathology. Moreover, these "heroic" doses of calomel cannot be too strongly discountenanced, for "they were first recommended on the strength of a crazy hypothesis" alone. The practice described has also frequently proved successful in Jamaica; but, according to Dr. Davy, it was not attended with beneficial results at Barbadoes; and the American physicians at New Orleans have not found it to answer their expectations in stopping the fever, while the large and frequently repeated doses of quinine were often highly injurious (LAWSON). This discrepancy may in some measure be explained by what has been stated at the outset in explaining the pathology of this peculiar fever. It is in cases where the fever is of the periodic or paludal form, and not the continuous or true yellow fever, that quinine may be of use, if the system can be brought under its influence. Dr. Lawson is of opinion that calomel is a very essential part of the treatment. It acts powerfully on the colon, causing a profuse dark pultaceous stool, and seems to anticipate that condition of the intestine when its secretion ceases.

It is an object to keep the bowels freely open, and to get the skin to act freely. The main object of the physician should be to moderate excessive action in any organ, and to endeavour to bring about as complete a crisis as possible about the fifth day, the natural period of resolution of the disease. For this purpose nothing is of more importance than to re-establish the secreting function of the colon, and to obtain fœculent evacuations—not mere bilious discharges—but proper dark-brown fœculent stools (LAWSON). Gentle excitement of an extensive portion of the lining membrane of the colon, with frequent copious enemata of a pint and a half of warm water, in which a table-spoonful of

common salt has been dissolved, and to which has been added a table-spoonful of olive oil, or more stimulating enemata, deserve a full and careful trial. Powerful stimulating enemata or drastic purgation serve but to increase the mischief (LAWSON). All the depurative functions must be kept in activity. Turpentine is recommended by Dr. Copland, by Dr. Archibald Smith, and Mr. Laird, of H. M. S. "Medea"—one drachm doses by the mouth, or half-ounce doses as a lavement, several times daily, using it also as an epithem on the abdomen.

"When the mucous surfaces," writes Dr. Blair, "as indicated by the tongue, were denuded of epithelium, the use of *gum water* was decidedly beneficial. It lubricated, defended, and soothed the raw surfaces. The strength was generally three drachms of the purest powdered gum arabic dissolved in six ounces of cold water, and a table-spoonful of this given every one or two hours. The patient at last gets tired of it; but for thirty-six or forty-eight hours of the most critical period of the disease it is used without dissatisfaction, and then can be substituted by, or alternated with, smoothly and thin-made arrow-root. When the heat of surface was ardent, a *wet sheet* or *blanket* was used for the reduction of temperature by evaporation, with frequently very good effect. But in the later stages of the disease, when the skin was cool or cold, the patient seemed to have an instinctive craving for its re-application, and frequently asked to be put into it. There would appear to be two causes for this feeling. We find it to exist in cases in which black vomit has been copious, and the associated thirst distressing. Also in cases where there has been no black vomit of any consequence, and the breath is highly ammoniacal. In the former class of cases the stomach ceases to be an *absorbing* viscus in anything like the proportion of its secretions and transudations. The skin is therefore employed in reducing the crisis of the blood by the absorption of water, as shipwrecked mariners are said to quench their thirst. But not only does the skin afford an inlet for the imbibition of diluting fluids, but the softening of the cuticle would seem to afford an additional outlet for the noxious elements of the circulation; and it is probably in this direction we must in future look for auxiliary means of relieving the blood of its poisonous, metamorphosed, and effete constituents, the onus of which is now thrown on such vital organs as the stomach and lungs. At one time,

the heat of the surface was so ardent and persistent, that the wet sheet failed to reduce it effectually. For these cases the effects of tobacco injection were once or twice only tried.

"The *food* during the course of yellow fever should be of the blandest description: chicken tea, arrow-root, sago, and barley water constituting the chief articles; and these should be taken in minute quantities at a time when the stomach is at all irritable. This rule applies to drinks of all kinds. The patient is greedy for a large draught of fluids; but by sucking them through a glass tube of small bore, or by the tea or table-spoonful, they are much more likely to be retained. A cold infusion of oatmeal was found an agreeable drink for the Scotch seamen, of which they did not seem to tire. A dislike of sweets was observed among the patients; and when lemonade was asked for, the usual quantity of sugar was objected to, probably from its rendering the liquid too dense for ready absorption by the stomach, and therefore less quenching. *Tea* was found so uniformly to disagree with the patients, and cause vomiting, particularly in the advanced stages, that at length it had to be expunged from the yellow fever dietary. Dilute alcoholic drinks were given freely, and with good effect. Where brandy could be obtained pure (tolerably free from acidity and fusel oil), and was well diluted with water, that spirit answered every indication. Sometimes the effervescing wines were relished and retained, but they are very liable to the objections of containing foreign matters and the products of mismanaged fermentation."

"During the course of the disease, *auxiliary treatment* was required to meet contingent symptoms. This was embraced chiefly in the use of local and general blood-letting, croton oil, morphine, ether, vesicatories, hydrocyanic acid, and the creasote before referred to. Cupping, leeching, and blistering were found useful in relieving the primary head symptoms and irritability of stomach, when applied respectively to the nape of neck or epigastrium. Tenderness over the liver seemed also benefited by these applications; but I cannot say I have ever seen any benefit resulting from their application over the kidneys, with the view of relieving that congestion of which albuminosity of the urine and suppression are the indices. In only one instance have I seen strangury follow the application of blisters in this malady, and in that case it seemed to exercise no injurious effect. When the

primary re-action was violent, and the face was turgid, and the head symptoms severe, arteriotomy was performed, and with benefit. In a few such cases, and when the patient was young, strong, and full-blooded, and where the dynamic congestions were so violent that the vessels yielded to the turgescence and impulse, and blood corpuscles without tube casts, or even but a haze of albumen, was present in the urine, the arm was opened, and free bleeding relieved the tension of the vascular system. In such cases convalescence was slow and unsatisfactory, but the immediate results were beneficial. In general, the bowels responded easily to the action of mild purgatives; but a cluster of cases occurred about fifteen months after the commencement of the epidemic, in which *croton* oil was required to follow the resolvent dose. *Hydrocyanic acid* was supposed beneficial in a few cases in abating the primary irritability of the stomach; and being easily taken, may be borne in mind by the practitioner, as a variety of such resources are at times required. *Ether* was frequently attended with marked advantage in removing or abating the distressing symptom, hiccup; but we used it also as a diffusible stimulant, and where acceptable to the patient, is fully equal to brandy for that purpose."

"Of all the auxiliaries which must be occasionally impressed into the service of the patient, by far the most important is *morphine*. Its administration, however, involves more knowledge, discernment, and judgment, on the part of the practitioner, than any other drug he has to deal with. The most salutary effects were observed from its use in some cases; but a number of cases occurred in which it was so manifestly detrimental that its use was about being relinquished again. In some of these cases in which it was injurious, its first effects for some hours seemed favourable; and for a considerable time no criterion was known for its administration. I suspect that the injury frequently arising from the use of morphine is chiefly due to its action on the secretions of the kidneys. It impairs that function; and where the march of symptoms is already verging on that of urinary suppression, although the tranquillizing effects of the drug may be pleasant at the time and well marked, it indirectly induces head symptoms, and adds to the uræmic poisoning. The rule, therefore, would be, *not to give it when there is suppression or tendency to suppression of urine*. Of course, if the restlessness, or sleep-

lessness, or suffering is extreme, it becomes a question for deliberation whether, even in suppression of urine or tendency to it, the relief which is sure immediately to follow the dose of morphine will compensate for the jeopardy of life? The necessity must be extreme indeed that would justify, for present use, the surrender of the smallest chance in favour of ultimate recovery. Its beneficial effects are most visible and unqualified in those cases wherein the disease has been imperfectly aborted, and which, after a few doses of the *aqua acetatis ammoniæ* and *camphor water*, will induce a good night's rest, out of which the patient awakes free from disease. Morphine is perfectly safe while the urine is non-albuminous. The effect of yellow fever on the system is to make it sensitive to narcotics. Cases of *delirium tremens* with a taint of the epidemic will not bear that deliberate use of opiates of which it is normally so tolerant; and a dose such as that which the anodyne draught contains is too much for yellow fever, though never found so for intermittents. After many observations I have come to the conclusion that, for an adult, eight drops of the solution of the acetate (one-fourth of a grain) should be the maximum dose, and should rarely be repeated within twenty-four hours."

The congestion of the kidneys, about the fourth or fifth day, requires watching, so as to diminish the chances of suppression, by reducing congestion, and preventing the closure of uriniferous tubes by accumulated epithelium. For this purpose Dr. Lawson recommends cupping, either dry or with the abstraction of blood; and the use of frictions, with stimulating liniments over the loins. These, with warm baths or hot-air baths, deserve a full trial; and small doses of *acetate of ammonia*, with *potash* or *soda*, or their salts in common use, with diaphoretics (so as to act gently on both kidneys and skin), may prove beneficial.

SECTION. III.—THE LITORAL, MALARIAL, OR PALUDAL FEVERS.

Characterized by one or other of these names, three varieties or forms of fever are understood to exist, having many essential features in common. These are *intermittent fever* or *ague*, *remittent fever*, and a variety of *yellow fever*. The specific or contagious form of *yellow fever* is now understood to be a different fever from remittent and intermittent fever, and it has been

considered separately as a continuous fever *sui generis*. The malarious form of *yellow fever* is, on the other hand, the same in kind as the intermittent and remittent fevers, but varies greatly in the extremes of its severity. So great, indeed, are the differences induced by the common malarious poison, that "if any one had seen only the milder forms of *remittent fever*, and had no opportunity of tracing up its several grades, he might well believe, when he saw suddenly the severest variety, that he had before him a distinct affection" (ALISON). Such a belief is entertained by not a few. All of the three fevers, however, which are now about to be considered are similar, pathologically; while all take their origin from terrestrial aëriform emanations, which are sometimes rendered more active or dangerous in connection with human beings congregated together, and in certain relations as to physical climate, and particularly as to temperature.

Pathology.—In these forms of fever a malarial poison of an unknown kind, generated chiefly in paludal regions or litoral districts, is absorbed, and affects the blood, as cholera, typhus, and other miasmatic poisons do. The poison, in the absence of any better name, is known as "*malaria*;" and as physicians have merely inferred the existence of such a poison, no exact knowledge has yet been obtained as to its nature and source. Indeed, it still remains to be shown that *malaria* have a substantial existence. No poisonous principle has yet been chemically demonstrated in the air of malarious regions. But many other acknowledged disease poisons are in a similar predicament as to proofs of their substantial existence; and the general impression with regard to *malaria* is, that it is presumed to exist as a gaseous fluid in the atmosphere of certain regions.

After a period of latency, more or less long, functional disorders of the great nervous centres are brought about, terminating in the phenomena either of intermitting, remitting, or yellow fever. These fevers may exist without any alteration of structure being set up, and the patient often dies from the severest forms, with hardly a trace of disease being discoverable. In the milder forms of these fevers, however, a greater number of organs and tissues are morbidly altered than perhaps in any other disease, as the liver, spleen, lungs, heart, brain, and the serous and mucous membranes of the body generally. The specific action

of the malarial poison, within certain limits, may be said to be in the inverse ratio of the intensity of the fever which attends its action. The affections of the liver and spleen also vary greatly, according to the country; for in some parts of India the spleen is the organ chiefly affected, while in other districts it is the liver; the nature of the country, perhaps of the soil, impressing evidently some peculiar character on the poison.

The patients labouring under intermittent fever in this country generally recover under medical treatment, without any manifest derangement either of structure or of function of any organ or tissue. When, however, the disease is neglected the liver may suffer, the disordered function of that organ being generally indicated by jaundice; or inflammation of the liver may ensue, of which jaundice may or may not be a symptom; and this inflammation may be acute or chronic, diffuse or limited to one place. If a liver, previously healthy, becomes the seat of diffuse inflammation, it is of the deepest hepatic tint, and loaded with blood; and we find it also often greatly hypertrophied, filling the abdominal and pelvic cavities, and according as the inflammation is acute or chronic, either greatly indurated or so softened as to be easily broken down. In a few instances this inflammation may terminate in abscess, generally of the usual phlegmonous character. On the contrary, if the liver be previously diseased, its colour, even when the seat of abscess, or otherwise most acutely inflamed, may be of the palest yellow, and its texture sometimes so soft and broken down that the larger blood-vessels may be dissected out with the fingers, or so indurated as to form a shapeless mass of varying magnitude. When abscess forms it may rupture into the duodenum, or into the cavity of the abdomen, or it may point externally.

The paludal poisoning also often produces structural alteration of the spleen. In these cases that organ has been found sometimes so enlarged as to weigh from ten to thirty pounds, greatly exceeding the liver in size (ague cake), while in other cases it is sometimes even less than natural. In consistency, also, it varies from a state of almost fluidity, a mere bag of blood, to a hardened mass with a distinct indurated edge. It is sometimes the seat of abscess.

The functions of the peritoneum may be alone deranged, so as to produce dropsy; but every form of peritoneal inflammation,

may precede or accompany the *ascites*,—as the serous or the purulent, with diffuse or partial local adhesions; and these forms may be either acute or chronic, but more commonly they are acute.

These are the most usual alterations of function and of structure in the mild paludal fevers of the present day; and in estimating the relative frequency of these secondary affections, *ascites* is the most common, then *jaundice*; while *peritonitis*, *hepatitis*, and *splenitis* are less frequent, and occur, perhaps, in nearly equal proportions.

The pathological phenomena which attend severe intermittent and remittent fever are much more severe, and extend over a greater number of organs. The information afforded us by the dissections of Davis and the observations of Sir Gilbert Blane, in the cases of the Walcheren remittent; of Jackson in those of the West Indies; of Burnett in the Mediterranean, enable us to understand at least the tendency of the morbid action. Sir Gilbert Blane, in his observations on the Walcheren fever, remarks, that the structural derangements were more frequent (especially swelling of the liver and spleen), which then occurred in a very few weeks. Such results seldom occur in England, except under a long continuance of the disease, or after frequent relapses. The morbid changes also extended to the mucous membrane of the stomach, which in a few instances was inflamed and ulcerated, and the ulcers had generally a sharp perpendicular edge, as if made with a punch. In cases which died dysenteric, the large intestines, and more particularly the sigmoid flexure and the rectum, were always much contracted, thickened, inflamed, and ulcerated; the ulcers being often so numerous and so confluent that the whole inner surface of the gut appeared in a state of granulation. There is a marked tendency in the phenomena of these paludal fevers to become inflammatory, the congestion of some organ proceeding at once to exudation from the blood-vessels into its parenchyma, which appears to be the cause of prostration and of fatal results. "The significant term *bilious*," writes Sir Ranald Martin, "as applied to these fevers of the East, is not an accidental or a misapplied term, as modern statistics fully show. A severe disturbance of the hepatic function is almost universal in the progress of the remittent fevers in the East."

There is another remarkable tendency to be noticed in the

persistent effects produced by intermittents—namely, that they impress a character of periodicity to subsequent ailments, especially neuralgic affections; and the disposition to the recurrence of these diseases seems to last for life. Susceptibility to the action of the paludal poison does not diminish, but rather increases by continued residence where it prevails. The returns published by the War Office and Army Medical Department show such a result in the West Indies. Thus, while the annual mortality among the troops resident one year in Jamaica was 77 per 1,000, mean strength, in those resident two years it was 87 per 1,000, while of those still longer resident it was no less than 93 per 1,000.

“In making calculations of efficient force,” writes Sir James Macgrigor, “this description of men could not be relied on for operations long continued in the field” (speaking of men who had suffered from an attack of paludal fever), for “we found that in those who were convalescent or lately recovered from ague, the causes next prone to reproduce the disease were exposure to a shower of rain, or wetting the feet, full exposure to the direct rays of the sun, or to cold, with intemperance, irregularity, or great fatigue.” There are many instances also of the same person being repeatedly attacked with the West Indian fever. Sir Ranald Martin writes with regard to himself, that “after a residence of ten years in Europe, I happened to pass three nights at the best hotel in Strasburg, at a time when ague prevailed in the garrison amongst the French soldiers who had served in Algeria; and two days after quitting the town I was seized at the hour of eleven A.M. (the hour at which ague used to commence with me in India) with ague, and I was the only person of the party who was so affected.”

The peritoneum is very generally inflamed, especially that portion which covers the different organs, caused perhaps by extension of the morbid irritability of those parts, and from this circumstance the different viscera often adhere to each other and to the walls of the abdomen; and sometimes it also happens that an encysted abscess forms between the adherent surfaces. In other cases the intestines were often seen floating in serum or pus, or glued together. In dropsical and dysenteric cases the peritoneum was unusually thickened, while abscesses occasionally formed in the folds of the mesentery.

The serous membranes of the chest were also frequently the seat of disease. Sometimes a dropsical effusion filled the cavity, in other cases the *pleura pulmonalis* was almost universally adherent to the *pleura costalis*, while in others the whole surface of the membrane was covered with recently effused coagulable lymph. In some cases the *anasarca* was general, but the more remarkable effusion of serum was around the epiglottis, when it formed a large tumor, completely closing up the *rima glottidis* and suffocating the patient. The epiglottis also was in some cases found ulcerated and thickened. *Bronchitis* and *laryngitis* were not unfrequent, while the substance of the lung was sometimes the seat of severe inflammation, terminating either in the red or grey hepatization, or with effusion of serum.

The heart itself did not always escape, for the pericardium was frequently found inflamed and covered with lymph, or it was the seat of serous effusion.

The membranes of the brain were also often the seat of much inflammation, lymph or serum being often effused between them, while much fluid was occasionally found in the ventricles. The substance of the brain also, especially in dropsical cases, was so soft as hardly to bear the knife.

The yellow tint of the skin, so often observed in severe remittent cases, appears to depend on changes in the blood, in the capillary vessels of the skin, and conjunctivæ, and not always on bile, as popularly believed. So long as the capillary vessels continue distended, and the blood they contain remains more or less stationary, its component parts undergo a partial separation.

The numerous minute vessels which give the skin of the face its red distended appearance, the conjunctivæ an injected aspect, and the eyes a ferretty look, ultimately renders the skin slightly yellow, and the conjunctivæ yellow, dull, and muddy. In some cases, however, there is no doubt that bile also produces this effect.

When the paludal or litoral poison produces the severer forms of *remittent* and *malarious yellow fever*, it does not occasion any great amount of disorganization. In this respect the paludal poison follows the great law of poisons generally—namely, the dose being in excess, the patient dies before sufficient time has elapsed for the poison to set up its specific actions.

As a general principle, in the West Indies, in Africa, and indeed in all countries in which remittent fever is of the highest degree of intensity, the traces of continued diseased structure are always trifling, and generally limited to the stomach, the brain, the liver, or the spleen. When the stomach is affected, the mucous membrane of the pyloric orifice is for the most part inflamed, easily detached, and sometimes ulcerated. The contents of the stomach are either a viscid mucus, a black melanic matter, or pure blood, which is sometimes thrown up during life. In seven-tenths of those examined at Barcelona in 1821 the stomach contained melanic matter, like soot mixed with water, or coffee grounds, while in one-eighth it contained pure blood. The duodenum and small intestines, and not unfrequently the gall-bladder, were also inflamed. Dr. Barry and M. Ruz speak of having observed Brunner's glands to be enlarged, but never Peyer's. The small intestines are filled with the same matters as the stomach, but more viscid, thicker, and more resembling tar; and in the large intestines these matters were often mixed with clotted blood. The liver and spleen have usually been found healthy. Louis states that, in the epidemic at Gibraltar, he found the liver of a pale yellow colour—a circumstance he considers to be the great pathognomic sign of the disease. It is probable, however, that this generalization is hasty, for it was not observed by our own naval and military officers, and has since been found wanting in the epidemic at Martinique. The substance of the brain is in general healthy, and sometimes a little softened, while the membranes are only occasionally inflamed, and the usual effusion of serum exists.

The most general and constant anatomical fact observed amongst the morbid appearances after death from malarious *yellow fever* is the almost universal *bloodiness* of the areolar or binding tissues of the body, and organs generally.

When the textures are cut into, blood flows out from the subcutaneous binding tissue; the mesentery is loaded with it; the tissue binding the gullet and windpipe and aorta to the vertebral column is full of blood; and so is the areolar tissue in the mediastinal spaces, and surrounding the kidneys. From congestions, or extravasations into the submucous binding tissue of the intestines, they appear slate-coloured, and as if gangrenous, when seen through the peritoneum. The costal

The opinion regarding the pathology of *yellow fever*, which holds that it is "*an intense form of the bilious remittent of the tropics*," has given rise to much discussion.

The investigation of this point, however, is attended with extreme difficulties, and is to be carried out with reference to two questions especially, namely,—(1.) The type or mode of progress of the symptoms in mild and severe cases, compared with cases of remittent fever in all grades of severity and stages; (2.) The pathological characters of the morbid processes which take place in severe forms of yellow fever, compared with those of remittent.

Three opinions have thus been held regarding the essential nature of yellow fever. These are,—(1.) That there is a *malarious form of yellow fever* which is an intense and virulent form of remittent, and which becomes more or less a continued fever (CLEGHORN, LIND, HUNTER, ALISON, CRAIGIE, MARTIN). (2.) That it is a continued fever of a specific kind, different from all other continued fevers (CULLEN, CHISHOLM, BLANE, WOOD, HIRSCH, ARNOLD, MACLEAN). (3.) That it is a mixed fever, of a type variable between the remittent and continued forms (JACKSON, MOSELEY).

The grounds upon which the first of these opinions is accepted are—that in the symptoms and effects, progress and pathology, of remittent fevers and ordinary cases of yellow fever, we are unable to discover any essential differences, but merely what is due to intensity of morbid action, degree, and rapidity of progress. Comparisons have been drawn in this way between the summer and autumnal *remittents* of the south of Europe, the *remittent* fever of the Mediterranean, the tropical *remittent* of the East and West Indies and Central Africa, the Bulam fever, or the fever of Sierra Leone and Fernando Po, on the one hand, and between some of the cases of the *yellow fever* of Cadiz, Gibraltar, Malaga, Carthage, Leghorn, Vera Cruz, Havanna, Jamaica, St. Domingo, the West Indies generally, and the United States, on the other. There are also cases in which no distinction can be drawn between the symptoms, the effects, or the rapidity of action, if the case (considered to be a remittent) is compared with some cases of so-called yellow fever. In other words, it is not possible to distinguish some cases, and say with certainty that they are cases of remittent rather than of yellow fever, or

of yellow fever and not remittent. Dr. Craigie has put the case in the most distinct terms, as follows:—"We remark," says he, "the same intensity of headache and suffusion and muddiness of eye at the commencement, the same anguish and pain at stomach, the same unquenchable thirst and incessant vomiting, the same temporary abatement at the period when cerebro-meningeal effusion is commencing, the same yellow suffusion of the skin of the superior parts of the body, the same exacerbation of symptoms at the commencement and establishment of gastro-enteric disorganization, the same character of discharges, the same mode of termination, and the same morbid changes in the dead subject, in remittent and in yellow fever. The islands of Sicily, Sardinia, Corfu, Cephalonias, and Zante, present annually many cases of exquisite yellow fever in the form of the endemic remittent of summer and autumn.

"Conversely, we observe in all yellow fever epidemics cases of ordinary fever, in which no difference can be traced between their symptoms and those of the remittents which prevail in the summer and autumn of Spain, Italy, and the Mediterranean coasts and islands, of the East and West Indies, Central Africa, and the southern division of the United States. Among the cases of the virulent yellow fever of Vera Cruz, the Havanna, the West India Islands, and the United States, the physician daily recognizes cases which resemble, in all respects of symptoms, progress, and termination, the remittents of these countries during ordinary seasons. The most practised and accurate observer can trace no palpable difference unless in degree; and even this is not always cognizable. In the different yellow fever epidemics of Leghorn, Cadiz, Gibraltar, and Carthage, there appeared numerous cases of fever which, under other circumstances, would have been admitted to be examples of remittent fever. The general epidemic prevalence, however, caused the whole to be classed as yellow fever.

"Lastly, while we remark that the forms of remittent fever differ not in kind, but in degree only, that difference is so graduated that it has attracted the attention of physicians in almost all ages. It has been long observed that the remittents of Holland, France, and Germany were only milder in character and longer in course than those of Spain, Italy, Greece, and the Mediterranean Islands, and that those of the latter were merely milder in

symptoms, and less rapid in progress, than those of the tropical regions. This was remarked by Cleghorn, Lind, Senac, Pringle, John Hunter, and Jackson. More recently it has been observed by those who have treated the *remittent fever* of the Mediterranean, that this disease bears the same relation to the endemic yellow fever of the West India Islands when sporadic, which the remittents of France, Holland, and Germany do to the Mediterranean fever. It appears, therefore, chiefly by its epidemic character, that the virulent (specific?) yellow fever is to be distinguished, whether occurring in Europe or in the Antilles.

"In conclusion, I conceive it is impossible to resist the inference that in favourable situations, such as the Mediterranean islands and coasts, the west coast of Africa, especially Senegal, Sierra Leone, Fernando Po, and the Bight of Benin, and in the East and West Indies, remittent fever may, in certain seasons and in proper subjects, assume all the usual characters of exquisite yellow fever (*i. e.*, malarious fever with *yellowness*), and, providing there may be a sufficient supply of subjects, may prevail among them so extensively as to display the epidemic character.

"These principles, which are indisputably established by numerous facts in our military, naval, and colonial history of late years, are of the greatest importance in suggesting the means of prevention, and in showing that in countries essentially insalubrious, all attempts at colonization must be abortive, and that the necessary evils of physical situation, climate, and season, ought to be counteracted by precautions in encampment, in clothing, in regimen, and discipline."

Causes and Modes of Propagation.—Facts tending to establish the concurrence of certain terrestrial, gaseous, or meteorological phenomena, as necessary to the generation and development of these fevers, are of a very conflicting nature. The concurrence of some, however, are sufficiently obvious, and are applicable to the litoral and paludal fevers generally.

By numerous observations it has been established that some æriform material of a poisonous nature is exhaled from marshy or wet grounds in the progress of drying. Agues have always been observed to be the diseases of moist or marshy districts; and to prevail most in low, swampy, and humid countries, where seasons of considerable heat occur. The vicinity of marshes, or of a

district that has at some recent time been under water; the banks of great lakes, and the shores of great rivers and seas, where the water flows slowly, and in some places stagnates in shallow rivers over land alluvial, low, and flat; extensive flat tracts of wood, where much moisture is constantly present, where the process of drying is uninterrupted, and yet the surface constantly exhaling humidity;—these are some of the terrestrial physical conditions in which the paludal and the litoral fevers are found to abound. It must also be admitted, however, that these diseases do not prevail in *all* marshy districts, and they cannot, in some cases, be traced to a residence in the vicinity of marshes. Dr. Wood gives an interesting example of the occurrence of ague from an *irritant cause*, combined with the force of habit. “For seven successive nights M. Brachet bathed, at midnight, in the river Saone, towards the close of October, when the water was cold. Retiring to bed after each bath, and covering himself warmly, considerable re-action took place, which terminated in perspiration. At the end of the seventh day he ceased to bathe, but was, nevertheless, nightly, about the same hour, attacked with a regular intermittent paroxysm, consisting of the cold, hot, and sweating stages, which returned for about a week, when it ceased spontaneously on the occurrence of an event which kept him out of his bed at the hour of paroxysm, and induced him to take a ride on horseback, which excited and warmed him.” Cases having their origin in such causes, however, are of exceedingly rare occurrence, so far as the records of medicine show.

It is found that simple moisture is not adequate to the production of ague. Sailors on shipboard are not affected until they approach the shore or land on the coast; but the chemical analysis of marsh air has not furnished any useful information in relation to its fever-bearing properties.

The concurrence of circumstances under which paludal and litoral fevers have been observed to become developed may be shortly stated as follows:—(1.) A certain degree of heat. A high temperature is especially favourable to the production of malaria, and the more so when acting on moist alluvial soil. (2.) A certain relation as to season, variable with the geography of the locality in which such fevers prevail. The season of the year most marked in tropical climates is that which immediately

succeeds the cessation of the rains, or, as it is called, "the drying up of the rains." (3.) Low swampy grounds and extensive rice fields are well-known sources of malaria. In such districts clouds of mist are often seen, wafted along the earth's surface for miles; and it is believed that malaria, whatever be their nature, cling to such mists. But although it has been observed that absolute marshes do not always produce agues, nor that agues are always due to obvious marshes, yet it is generally found that in districts where such paludal fevers abound the surface is porous, penetrable, and retentive of moisture, although it does not appear on the surface of the ground; that the district had been at one time submerged, and that it continued slowly but constantly to undergo the process of desiccation; or while at certain seasons it imbibes moisture from local or meteorological sources, at other seasons it undergoes the drying process under intense solar heat. Such are some of the most sickly and febriferous districts in Europe, India, and America. For example, the Maremma of Italy; the district of the Lakes near Varna, in Bulgaria; many districts in Burmah; many newly cleared tracts in North America; and many parts in the south of Spain. In most of these places the conditions of the surface of the ground are very much alike. While no obvious appearance of a marsh exists, the vigour of vegetation is extreme, amphibious animals abound of the batrachian kind, plants and cephalapodous mollusca of notoriously marshy regions find a habitat, and the rich alluvial soil is so imperfectly cultivated that the process of vegetation is not adequately exhausted, and a surface of humid ground is exposed to the solar heat, and so exhales a material which exercises a persistent deleterious influence on the human frame. It is believed that the number of insects and some reptiles with which a place abounds are more significant of its insalubrity than almost any other circumstance; and that a mixture of animal and vegetable matters undergoing decay give rise to miasms much more noxious than those resulting from vegetable matter alone. Dr. Ferguson, in *The Edinburgh Philosophical Transactions*, vol. ix., p. 273, was the first author who clearly proved that the drying of all porous soils, from which watery fluid readily evaporated, was the genuine source of exhalations capable of producing the paludal fevers; and that the febriferous activity of these exhalations was influenced by

the character of the season, the moisture, the temperature, and the aërial movements of the atmosphere.

The evidence regarding the geological nature of soil as a cause of ague is somewhat conflicting. It is a fact that the usual localities in which paludal fevers abound are those in which the soil consists of mineral, vegetable, and animal matters, mixed together in such proportions and of such constituents chemically as tend to absorb moisture and retain it, and subsequently to decompose. Such soils are known as *alluvial*. Paludal fevers abound, however, where soils of a different nature predominate. Level plains of sand, or dry, loose, open gravel, are soils where malarial fevers have prevailed.

"The first time I saw intermittent and remittent fever become epidemic in an army," writes Dr. Ferguson, "was in 1794, when, after a very dry and hot summer, our troops in the month of August took up an encampment at Rosendaal, in South Holland. The soil was a level plain of sand, with perfectly dry surface, where no vegetation existed, or *could* exist, but stunted heath plants. On digging it was universally found percolated with water to within a few inches of the surface, which, so far from being at all putrid, was perfectly potable in all the wells of the camp."

High grounds near exposed marshes are often more unhealthy than the places immediately adjoining which are on a level with them. Rocky places, such as Ciudad Rodrigo, Gibraltar, and Malaga, have now and then been ravaged by epidemics of litoral and paludal fevers, and the rocky shores and islands of the Mediterranean—for instance, Minorca, Sardinia, Sicily, Cephalonia, and all the Cyclades—abound as much in these fevers as the most level parts of Holland; and the West India Islands, most of which, although coralline rocks, are the native soil of these diseases. Soil composed of tenacious or stiff clay (argillaceous) is highly retentive of moisture, and is difficult either to dry or to drain. The basin of the Thames, comprehending Middlesex, Essex, Surrey, and Kent, is almost entirely clay land, and is the district of England where agues most of all prevail, especially along the banks of the Medway and the Thames. In the days of Sir Gilbert Blane agues had almost entirely ceased to occur in London, and the cases which he treated he believed to have been imported from malarious districts around, and the same may be said of those of the present day. A hundred years before the

time of Sir Gilbert Blane, however, we find that agues prevailed in situations in the town of London where they are now wholly unknown, such as Russell Street, Covent Garden, Fleet Street, Fetter Lane, Newgate Street, Paternoster Row, Cheapside, Smithfield, Fenchurch Street, &c. At the present time ague rarely occurs in London except on the south side of the river, especially in Bermondsey and Rotherhithe, and chiefly in persons who have recently been exposed to malaria in Kent or Essex, and who have come from marshy districts, either quite recently or within a few months. The malarious influence, still in the metropolis, seems, however, sufficiently powerful to imprint a periodic character upon various local affections, and occasionally to give rise to fevers of a remittent type. Recently (in 1856) such affections have been unusually prevalent; but the forms of ague now met with in London are more tractable and milder than those which formerly prevailed (DR. PEACOCK).

It is observed that the surface of the earth may be dried either by the direct rays of the sun, or by currents of hot dry air wafted over it, or by both combined; but it is principally by the direct rays of the sun that the deleterious material of the soil is liberated; and it seems to be at a certain period of this "drying up" process that the exhalations are more potent than at another time in developing paludal fevers. The exposed grounds, after clearing off the copious vegetation from dense jungles, so as to admit the influence of the sun's rays in "drying up," is known to be a fertile source of malaria.

There appears also to be a certain state of the human frame which renders it more than usually susceptible to this disease. The natives of warm and tropical climates are much less frequently and less violently attacked with paludal or litoral fevers than settlers or visitors from other lands, such as the natives of Europe or the northern parts of America. In the Mediterranean, along the coast of Africa, in the East Indies, in West India Islands, in the southern States of the Union, new-comers from the northern latitudes are almost invariably attacked, and suffer much more severely from the fever than those who have been long in the country. It has been also noticed that those who, after residing in a territory where paludal fevers abound, have been out of it for some time, an augmented susceptibility to renewed attacks of the fever becomes manifest on their return (CRAIGIE).

Other causes, also, predispose to those fevers, and none more than laborious or fatiguing duty in military or naval operations, labouring in the sun, excess in eating or drinking, intellectual exertion combined with bodily fatigue, and a crowded state of the population. Indeed, *insolatio*, or heat apoplexy, is regarded by many as a form of remittent fever (JOHNSTON, MARTIN, HILL).

When a remittent fever, or other paludal or litoral fever, has, under certain concurrent circumstances of weather, season, and physical peculiarities, made its appearance in any locality, it necessarily attacks all those who are by constitution, habit, and age, susceptible and predisposed; and the majority of these, especially if enfeebled by previous dynamic or organic disease, it destroys. The population, therefore, which outlives such an epidemic visitation, are no longer equally susceptible, and are greatly less likely to be attacked the ensuing season, unless it is more febriferous than the past, which, though sometimes, is not generally the case. The effect of this, therefore, is, that while the endemial disease continues for a season to attack and destroy its *ordinary* annual proportion of the population, it does not for several years attack the *extraordinary* proportion, because that proportion is not yet ready for, or susceptible of its attacks. In the course of a few seasons, however, during which the young have grown up and become adult, the adult have become careless, and perhaps irregular and incautious by long immunity, and their constitutions have become less able to resist deleterious or morbid impressions, and the whole population of the place has become generally augmented by the arrival of persons from various other countries; a considerable number of susceptible persons is gradually formed, and at the end of five or six years, a place of 25,000 or 30,000 inhabitants becomes augmented perhaps by an additional fifth, or even by a third. The majority, or the totality of these persons, are all more or less predisposed and susceptible; a season of excessive drought ensues, in which solar desiccation and little wind form conspicuous characters; fever appears, and spreads at first slowly and gradually, but afterwards springing up in many points, rapidly coalesces; and in a short time is so general and fatal, that it assumes an epidemic character. The usual mortality in the meantime takes place; all the susceptible and predisposed subjects pass through the disease or are cut off; and the population of the place is

once more reduced to its state of epidemic insusceptibility and endemic or ordinary liability. This is the usual course of epidemics of paludal or litoral fevers in all countries within the tropics, and, indeed, within the 45th degree of north and south latitude (CRAIGIE).

A question of much interest in connection with *malaria* has given rise to considerable speculation. It relates to the *varieties* of the malarious poison. Is the poison which gives rise to a *quotidian ague* different from that which produces a *tertian*; and is this, in its turn, different from that which produces a *remittent fever*; and this again different from that which gives rise to the malarious form of *yellow fever*? Our knowledge is not yet sufficiently precise and extensive to settle these points. But when we see a large body of men placed under the same circumstances as to food, drink, and clothing, and labour, and exposed to the same causes of disease, in the same way, and in the same place, some of whom are seized with *quotidian ague*, others with *tertian*, and others with *remittent fever*, the presumption is that the same cause has produced different diseases, according to its intensity, the constitution of the individual, and the predisposing causes to which he may be subjected. Other facts also favour this presumption—namely, *remittent fevers* are known to pass into *quotidian agues*; and these again into *tertian agues*.

INTERMITTENT PALUDAL FEVER, or AGUE.

Definition.—*Febrile phenomena occurring in paroxysms, and observing a certain regular succession, characterized by unnatural coolness, unnatural heat, and unnatural cutaneous discharge, which prove a temporary crisis, and usher in a remission. These phenomena are developed in an uninterrupted series, or succession, more or less regular, which pass into each other by insensible steps.*

Symptoms.—The disease may be sudden in its attack, and without previous illness, but more commonly it is preceded by general indisposition, headache, weariness, pain in the limbs, thirst, loss of appetite, white tongue and frequent pulse, high-coloured urine and dark-coloured discharge from the bowels. These *prodromes* are accompanied with well-marked exacerbations and remissions of fever, displaying a periodic tendency. After

this feverish state has lasted from four days to a fortnight, the patient is seized with severe rigor, and the ague is manifested. The phenomena of an attack or "fit of the ague" are the following:—

The paroxysm, like the disease, may be of sudden invasion, and the patient may be in good health up to the time of attack; or it may be preceded by languor, debility, frequent yawnings, and great unwillingness to make the least exertion. In whichever way the cold stage begins, the patient experiences first a sensation of coldness of the extremities, then of the back, and lastly of the whole body; at the same time the nails turn blue, the features shrink and become pale and sharp, and if the case be severe, the whole body shrivels up, turns purple, and the surface of the skin assumes that rough condition popularly named "goose-skinned." The coldness increasing, the motor nerves of the fifth pair are affected, and the teeth begin to chatter; and this tremor extends to every muscle, till the whole body shakes with rigor. Cough, dyspnoea, and oppression of the præcordia now occur, with a painful sensation round the temples and down the back. The patient often suffers from nausea and vomiting, and the latter symptom is speedily followed by the hot stage. When the cold stage has lasted a period varying perhaps from half an hour to two hours and a half, a re-action takes place, accompanied by partial warmth, or flushings. These extend, and at length the whole body acquires a heat greater than natural, or from 105° to 107° . As the heat returns so also does the colour, and the body, especially the face, becomes now preternaturally swollen and red. The hot stage being now formed, the heart and arteries beat with unusual violence, and headache, with a frequent full pulse, and all the distressing symptoms of continued fever, are present. "The mean duration of this stage is from three to eight hours. At its close a gentle moisture breaks out, first on the forehead, and thence extends till the patient lies in a general sweat, sometimes so profuse as to soak the bed and linen as completely as if they had been dipped in water. After the sweat has continued to flow for some time the fever gradually abates, a state of apyrexia ensues, and the paroxysm is terminated, and, a sense of exhaustion excepted, the patient feels restored to health. Sometimes, however, he continues pale, debilitated, and incapable of all exertion, till, on the recurrence of the paroxysm, the symptoms just described are repeated.

Upon the approach of the attack the pulse is slow and feeble, but as the sense of coldness increases it becomes small, rapid, and irregular. When the hot stage forms it becomes full and strong, and on the sweat breaking out it again becomes soft, less rapid, and at length natural.

The tongue, in mild forms of the disease, is clean in the cold stage, white in the hot stage, and again cleans after the sweat has flowed. In severe cases the tongue is white during all the stages, and also during the apyrexia, while in the worst cases the tongue is brown in all the stages. Excepting some unusual instances, attended throughout with diarrhœa, the patient seldom passes a stool till towards the close of the paroxysm, when it is generally a loose one. It frequently also happens during the cold stage that tumors subside, or ulcers dry up, but the tumor generally reappears, and the ulcers discharge as soon as the sweating stage is formed.

The paroxysm of intermittent fever, of whatever description, is conventionally considered to terminate in twenty-four hours. The duration, however, varies in different types. These types have been named—*quotidian*, *tertian*, and *quartan*. Dr. Brown conceives the mean length of a *quotidian* to be sixteen hours, that of a *tertian* ten hours, and that of a *quartan* six hours.

The febrile paroxysm, or fit of intermittent fever, has three stages: a cold stage, a hot stage, and a sweating stage. These three stages are not necessarily of an equal duration, but vary greatly in different cases. The duration of the cold stage is from a few minutes to five or six hours, and in general, if the case be severe, the shorter the cold stage the longer the hot stage. The hot stage may last from half an hour to any period less than twenty-four hours. The sweating stage is generally shorter than either of the former, and sometimes does not exist at all. The rule, however, is, that the *quotidian* has the shortest cold stage and the longest hot stage; the *tertian* a longer cold stage and a shorter hot stage than the *quotidian*; while the *quartan* has the longest cold stage and the shortest hot stage of all the varieties.

The varieties of intermittent fever are distinguished from each other by the interval of time which elapses between each paroxysm. For instance, when the paroxysm returns every twenty-four hours it is termed a *quotidian*, when every forty-eight hours a *tertian*, and when every seventy-two hours a

quartan; and these primary types have been extended by early writers to every period comprised within a mensual or bimensual period.

Of these primary types it has been supposed that in this country the *tertian* is by far the most common type, then the *quartan*, and lastly the *quotidian* (WATSON, COPLAND, CHRISTISON). But this law is by no means general; for M. Maillot treated 2,354 cases of intermittent fever occurring in the French army in occupation of a portion of the northern shores of Africa, and he found of that number 1,582 were *quotidian*, 730 *tertian*, and 26 *quartan*. In the Peninsular war the *quotidian* was likewise the prevailing type, and at one time they were in the proportion of 16 to 1 of any other type. In the West Indies the *tertian* and the *quartan* are only about one-twelfth of the whole number of intermittents treated, the rest being *quotidians*. At Prome, in Burmah, 298 cases from the 2nd Bengal European Regiment, were admitted into hospital for intermittent fever in 1853, of which 249, or 83·5 *per cent.*, were *quotidian*; and 49, or 1·6 *per cent.*, were *tertian* (MURCHISON). The results given concerning the Madras Medical Service are very similar (WARING).

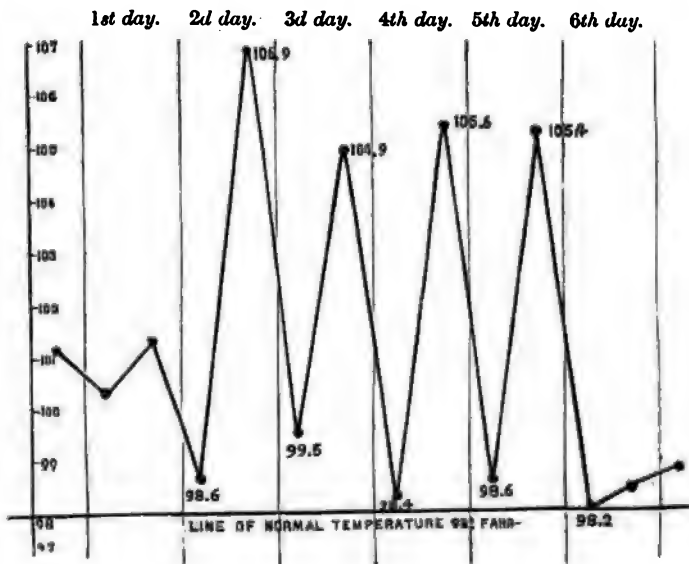
Most authors who have written on intermittent fever have stated that the accession of the *quotidian* paroxysm occurs early in the morning, that of the *tertian* about noon, and that of the *quartan* in the afternoon, between three and five o'clock. But to this law there are also many exceptions; for, according to Maillot, of 1,582 *quotidians*, 1,089 occurred from midnight to mid-day, and 493 from mid-day to midnight. This result is corroborated by Dr. Murchison's observations at Prome, in Burmah. In 86 out of 113 cases—*i. e.*, in 76 *per cent.*—the paroxysm commenced between midnight and noon; and in 27 cases, or 24 *per cent.*, between noon and midnight. The most frequent hours of attack were 9, 10, and 11 A.M.; and in 65 *per cent.* of the cases the paroxysms commenced between 8 A.M. and noon.

Of 730 *tertians*, 550 occurred from midnight to mid-day, and 180 from mid-day to midnight; out of 26 *quartans* also, 13 were seized from mid-day to midnight, and 13 from midnight to mid-day. As the most general conclusion, the paroxysm returned in a great majority of the *quotidian* cases from ten to twelve o'clock, and in the *tertian* from nine to twelve o'clock.

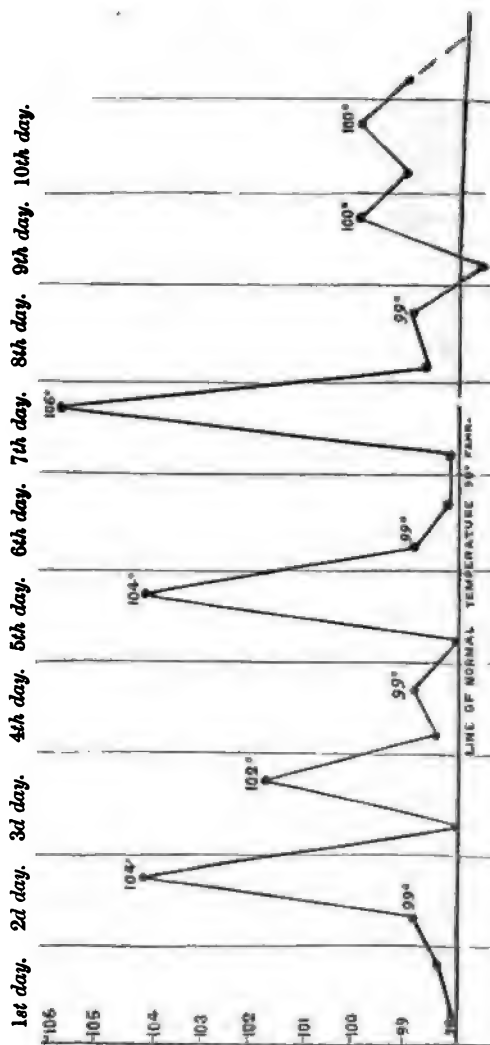
The Temperature in Cases of Intermittent Fever.—The paroxysm of fever, notwithstanding the subjective sensation of chilliness, is invariably indicated by a decided, sudden, and rapid rise of temperature. In this respect it resembles the accession of *febricula*; but while the latter requires only from eighteen to twenty-four hours from the commencement of the rise of temperature to the end of the defervescence, in perfectly normal cases of *intermittent fever* there is a whole day free of fever between every two days of the paroxysm. All the types of the fever present this characteristic peculiarity of a sudden and speedy rise of temperature to a high degree (mostly up to 105° or $106^{\circ}3$ Fahr.); and of an equally rapid and complete defervescence, till the period of another fever paroxysm comes about. This comportment as to temperature secures correctness of diagnosis in cases which may be obscure or ambiguous.

The following diagrams represent the variations of temperature in each of the three types of the fever:—

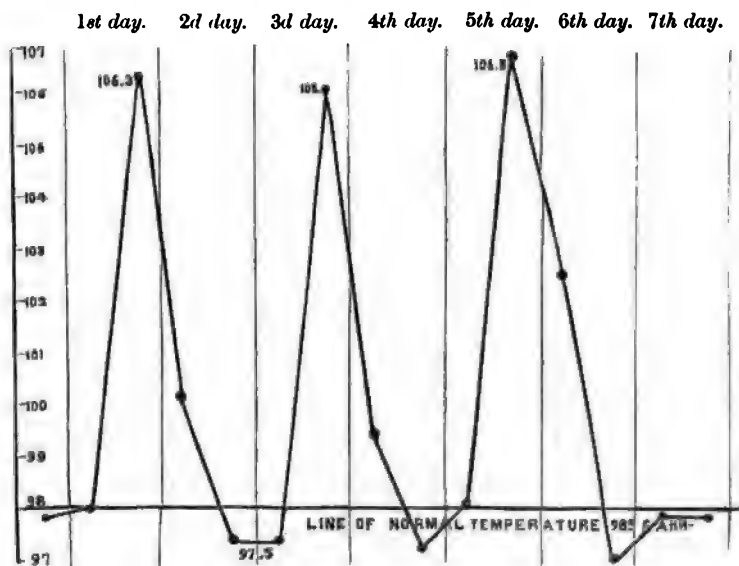
- (1.) TYPICAL RANGE OF TEMPERATURE IN A CASE OF INTERMITTENT FEVER OF QUOTIDIAN TYPE. THE RECORDS INDICATE THE HIGHEST AND LOWEST TEMPERATURES DAILY (Wunderlich).



(2.) TYPICAL RANGE OF TEMPERATURE IN A CASE OF INTERMITTENT FEVER OF REGULAR TERTIAN TYPE. THE RECORDS INDICATE THE HIGHEST AND LOWEST TEMPERATURES EACH DAY (Wunderlich).



- (3.) TYPICAL RANGE OF TEMPERATURE IN A CASE OF INTERMITTENT FEVER OF THE *QUARTAN TYPE*. THE RECORDS INDICATE THE HIGHEST AND LOWEST TEMPERATURES EACH DAY (Wunderlich).



In a paroxysm of intermittent fever much may be learned as to the relations of the excretions to temperature, and especially those of the urine, by observing the changes of temperature in very short spaces of time: for example, every fifteen or even every five minutes (MICHAEL, JONES, RINGER). The rise of temperature is found to begin with or even to precede the sensation of chilliness. It takes place at first slowly, and gradually, by about the middle of the period of chilliness, the rise becomes greatly accelerated, lasts through the period of the sensation of great heat, and may even extend into the sweating stage. At the commencement of the sweating stage small vacillations occur and continue for a short time; and when the sweating has fairly set in, the decrease of temperature begins and progresses steadily without any temporary rise, and with great regularity, decreasing at the rate of 2° Fahr. (or more) every five to fifteen minutes, till it has arrived, after several hours, at the normal heat.

Condition of the Urine.—The observations made on the condition of the urine are divisible into two series, as arranged by Dr. Parkes (l. c., p. 235). (1.) The condition of the urine during the fit, as compared with the urine of a non-febrile period; (2.) The condition of the urine of twenty-four hours during a fever day, as compared with the twenty-four hours' urine of a non-fever day.

During the fit and the apyretic period the water of the urine is increased in amount during the cold and hot stages; it is most abundant at the termination of the cold or commencement of the hot stage. It decreases during the latter part of the hot stage slowly, and rapidly during the sweating stage. The amount of increase is variable, and stands in no relation to the quantity of fluid drank, and may be great when this is small (RINGER). The amount of urea excreted by a person with ague, not actually suffering from a fit, is less than in health; but directly the fit commences, that is, at the very first moment of elevation of temperature, or even for some time before this, the urea suddenly increases—an increase which lasts during the cold and hot stages, and then sinks, sometimes gradually, sometimes suddenly, through the sweating stage, or into the commencement of the intermission. It then falls below the healthy average. The amount of increase is very variable, and the type of the fever has no influence upon it; but there seems to be a very close connection between the temperature and the amount of urea. The amount corresponding to a degree of Fahrenheit was greater at a high than a low temperature; and in the fit of each day the same amount was excreted for each degree of temperature. (*Med.-Ch. Trans.*, 1859.) This increase in the urea must be regarded, in some measure at least, as an indication of increased metamorphosis; and the close relation to the febrile heat certainly implies that it owns only this source, and is not caused by elimination following previous retention (PARKES).

The uric acid is greatly increased during the fit; and after the fit there are often deposits of urates, either spontaneously or on the addition of a drop of acid, and it seems probable that the increase in the excretion of uric acid continues for some time after the paroxysm; and the enlargement of the spleen in connection with this great increase of uric acid is probably not fortuitous (RANKE). The influence of quinine in diminishing

the amount of uric acid in health is of interest in connection with its effect upon malaria, and with the condition of the spleen in malarious fever (RANKE, BOSSE). The chloride of sodium is increased during the cold and hot stages to a great degree (TRAUBE, RINGER).

The results are contradictory regarding the urine of a fever day, compared with the urine of a fever-free day. This may be explained to some extent by the relative duration of the fit, compared with the fever-free period; and great differences may arise from the comparative length of the apyretic period on the fever days; also from the severity or the reverse of the fit, and from the amount of food and drink able to be taken.

With respect to abnormal constituents, albumen is found during the fit in a considerable number of cases. Blood, in some quantity, and renal cylinders are seen about as frequently as albumen; and occasionally chronic Bright's disease is a consequence of ague (PARKES, l. c.).

Treatment.—The treatment of agues varies in a great degree with the complications of the disease; such as the splenic and hepatic congestions, and the inflammatory affections of these and other organs, which are apt to be established during the existence of an intermittent fever. During each paroxysm, and subsequent to it, the condition of the two important organs referred to ought to be carefully observed; and it ought to be observed, also, whether any symptoms exist of congestion or actual exudation into the cranial or abdominal organs generally. When the type of the fever is malignant, or of a severe and complex kind, or when the complications are locally severe, it is difficult to cure an ague, which otherwise is a very manageable disease. During the cold stage, especially if it is of long duration, the liver, and especially the spleen, become turgid, the symptoms of which generally disappear with the sweating stage of the fever. It is when the endemic influences are severe, or when the attacks are prolonged over months and years, that these organs begin to suffer permanently from organic disease.

It is useless to attempt the cure of intermittent fever if the sufferer is permitted to remain within the sphere of malarial influences, or even in those geographical latitudes which may be said to be peculiarly malarial. It is now an established fact that none can become acclimated so as to withstand the influence of

malaria. When organic complications exist, they must, if possible, be remedied, because they maintain the morbid sensibility during the intermission, and prevent the cure of the ague.

In the warmer latitudes the following account of the treatment of intermittent fever is that laid down by Sir Ranald Martin. During the cold stage of the fever, while emetics seem to be indicated, they are not in repute. Warm drinks, ammonia, ether, camphor, and other diffusible stimuli, with the application of external warmth, seem to be preferred by most practitioners. During the hot stage, a full dose of calomel, with James's powder, should be given at once, and in three hours this should be followed by a brisk cathartic, diluent drinks being freely used meanwhile, along with some cooling diuretic. The tartarized antimony with nitrate of potash is recommended, as it answers the double purpose of exciting to action the functions of the skin and the kidneys. On the following morning, the intermission being completely established, the sulphate of quinine is to be administered. The influence of this medicine on a person in health, as observed by Dr. Ranke, is to diminish the quantity of uric acid in the urine (*Med. Times*, May 30, 1857)—an observation which has been recently confirmed by Bosse, of Dorpat, and is of interest in relation to its influence upon the spleen. It is to be given at intervals of three hours during the day, the patient being kept in bed and supplied with farinaceous food only. In the simple cases, when removed from the sphere of malarial influence, it may not be necessary to give mercurials more than once or twice, but active purgatives are always beneficial in relieving the full and congested state of the abdomen generally, during the continuance of intermittent fever. There are cases of intermittent fever, however, complicated with hepatic and other engorgements, and which continue to recur despite of all means, until a few doses of calomel, followed by purgatives, are administered; then the quinine, which before failed, will speedily cure the disease. The compound jalap powder, combined with calomel, is found very beneficial for this purpose. It appears that certain morbid conditions, both of liver and spleen, may produce and maintain the tendency to recurrences of ague. Ramazini relates the case of a patient harassed by an obstinate ague, and who was cured by mercurial frictions administered for syphilis. The influence of splenic disease in keeping up the morbid train of

actions of the original fever, and in producing relapses, has been recorded by M. Piorry. In more than 500 cases of ague in which he observed the state of the spleen, he comes to the following conclusions,—namely, that the organ is invariably enlarged during the progress of the fever, and that by the use of quinine the spleen diminishes in size; that its reduction in size bears some relation to the quantity of quinine taken; that the effect it produces upon the fever is in proportion to the reduction of the spleen; that the disease cured simultaneously with the subsidence of the splenic enlargement; and that the fever is apt to recur so long as the spleen exceeds its normal size.

When the fever is severe, accompanied with præcordial oppression, pain, fullness of the spleen or liver, or both, or where there is severe headache, or headache with giddiness, or an oppressive fullness of the chest, a general or a local blood-letting, or both combined, is imperatively demanded, as a means of promoting cure and preventing future evils. The antiperiodic power of bark, quinine, or arsenic, then becomes more easily developed. According to Dr. Copland, such depletion is almost an indispensable preliminary to the administration of quinine or bark, especially in the complicated and congestive forms of the disease. Without such depletion the medicine will either not be retained, or if retained, it will convert congestions or slight forms of inflammatory irritation into active inflammation or serious structural changes. It is chiefly to a neglect of such a mode of practice that unfavourable consequences have so often followed the use of bark, quinine, or arsenic; for, their influence is at first to interrupt secretion, or to over-excite, and subsequently to inflame organs already loaded, obstructed, and congested. But if blood is to be drawn at all, it should be drawn at the very onset of the hot stage, or that of re-action; and it should be regulated by the constitution, the age, and the habit of the patient, as already explained.

When, on the contrary, the fever assumes a low adynamic form, or when the patient is anæmic, mercurials must be carefully avoided in the treatment under all circumstances, and reliance placed on change of air, quinine, and chalybeates, and improved diet. With regard to liver complication in such cases, the nitro-muriatic acid is to be used internally, in doses of ten drops, three, four, or five times a-day, and externally in the form of baths.

With regard to the doses of quinine, some give very large quantities, such as twenty or thirty grains before the expected paroxysm (MAILLOT); others begin to administer the quinine on the subsiding of the paroxysm and during the sweating stage. According to the experience of Sir Ranald Martin (which has been great in tropical climates), the most rational plan is to give the quinine every three or four hours during the interval of freedom from fever, and in such doses as the urgency of the symptoms may demand. It is to be administered in solution, dissolved by a small quantity of *dilute* sulphuric acid. He also recommends antimony to be conjoined with the quinine in plethoric subjects; and, on the contrary, if the patient is feeble, irritable, or exhausted, he adds a few drops of tincture of opium to the antiperiodic. When arsenic is given in large doses, and its use prolonged, it permanently injures the circulating system and the mucous membranes of the stomach and bowels. It should be given in small doses, and not persevered in for more than eight or ten days. From six to eight drops of the solution of the College formula may be given every three hours during the interval of freedom from fever. Dr. Murchison's experience in Burmah goes to prove that the practice most effectual in at once checking the paroxysms of intermittent fever, is that of administering *one large dose of quinine during the third or sweating stage*. The usual dose given was twenty grains in a draught, with a few drops of sulphuric acid to dissolve the quinine. In no case did he observe any unpleasant symptoms from the physiological action of the drug, although many of the patients complained of slight buzzing in the ears—some amount of which is deemed necessary by Dr. Murchison for the success of the remedy; and when it occurs "it is a sign that there is no use of pushing the medicine farther." Christison also recommends the administration of large doses of quinine for the cure of tropical intermittent fevers, as deduced from the experience of the medical officers of the Madras army (*Madras Med. Reports*, 1831; *Ed. Med. and Surg. Jour.*, Jan. and April, 1855); and Superintending Surgeon Corbyn has long been convinced of the efficacy of this mode of giving quinine. (*Indian Annals of Medical Science*, Oct., 1853.) Repeated small doses, on the contrary, have been recommended in this country, by many eminent physicians, to be given during the intermissions (HOME, BROWN, BARKER, WATSON);

but the evidence of Dr. Murchison is so clear and decided, that one large dose, given as he recommends, seems more efficacious and more economical than repeated small doses.

When the intermittent fever has become chronic, or when it is organic disease of the liver or spleen as a secondary action, change of climate becomes a measure of necessity, and blood-letting can never be neglected. Sir Ranald Martin's personal experience does not allow of his writing in favourable terms of the practice of bleeding *in the cold stage of ague*. After quoting many eminent authorities, both for and against the practice, he remarks, "that in Europe, at least, the treatment of intermittent fevers by blood-letting in the cold stage, whilst it has the show of being prompt and energetic, proves, in effect, haphazard, systemless, operose, and tedious; and from all that I have seen and heard in the East, the result there has not been more favourable." The rule of practice laid down by Pringle and Cleghorn has received little or no addition in more recent times. Where general blood-letting is had recourse to in the treatment of intermittent fevers, whether simple or complicated, it should, as in the case of all other fevers, be performed at the very outset of the stage of re-action.

REMITTENT PALUDAL FEVER.

Definition.—*Febrile phenomena with exacerbations and remissions. The fever is characterized by great intensity of headache, the pain darting with a sense of tension across the forehead. The symptoms rise and fall in daily succeeding paroxysms, causing a stage of remission and a stage of exacerbation.*

Symptoms.—There are so many grades of intensity in remittent fever (varying as it does from a severe intermittent to malarious yellow fever), and so many different modifications are impressed on it from the great variety of country by which the poison is generated, that it is extremely difficult to generalize the phenomena.

The severer forms of remittent fever may be preceded by certain premonitory symptoms, such as languor, listlessness, restlessness, or chilliness; or there may be a want of appetite, anxiety, lassitude, pain at the epigastrium, pains in the loins and limbs, headache; slow, small, and irregular pulse; coldness

malaria. When organic complications possible, be remedied, because they ability during the intermission, and

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the evidence of its presence (1024 to 1030), acid, not coagulable by heat. When was tested for by Dr. Murchison in 1847, but never detected; and according to Jones's experiments it is very rarely present,—a point of difference of great importance as a distinction between the specific yellow fever (PARKES). In severe cases PARKES found the urea increased, and the uric acid increased, when it again increased, and the pigment increased (PARKES, l. c., p. 242). The fever, however, sometimes with sweating, but at other times with a sensible increase of perspiration. The first stage is generally the longest, lasting, in some cases, for twenty hours; but generally after twelve or thirteen hours the symptoms remit.

The remission which follows is as various as the fever. Sometimes it does not last longer than six hours; more commonly it extends to six, eight, ten, or even thirty-six hours. The fever then returns, and assumes a quotidian type, and has an exacerbation and perhaps nearly at the same time, yet more or less no regularity in the times either of its accessions or remissions.

The second or third paroxysm is always more severe than the first, and if the fever has not been checked during the first stage, usually neither any cold stage, rigor, nor even remission follows it. On the other hand, all the febrile symptoms are higher, the skin is hotter, the pulse more frequent, the pulse greater, the senses more confused, and the delirium, when that exists, more violent in degree and more frequent in its accession. Delirium with more or less loss of consciousness may not supervene till the third or fourth day, and is of a low wandering character in the asthenic form of the fever. The tongue becomes dry, hard, and brown, or black, and the teeth covered with brownish scales; and the pulse becomes small and weak. These symptoms sometimes occur with or without the black vomit, till they terminate in a more or less profound, great prostration, sub-coma, fetid breath, resembling the odour of a dead animal, and at length in death. The severe forms of the fever are sometimes accompanied with a yellowish

of the skin, and chilliness for one or several days before the commencement of the attack; these are symptoms which usher in a short cold stage. But in other cases the attack is sudden, and the patient, for instance, immediately after a hearty dinner, may be seized most unexpectedly with faintness, vertigo, nausea, confusion of thought, and these almost without a rigor, or a very short one, not exceeding half an hour; a hot stage follows, usually of much greater intensity than that which accompanies the worst forms of intermittent fever.

This hot stage, or period of exacerbation, generally commences in the forenoon of the day, or early in the afternoon, subsiding towards evening or in the early part of the night, the remissions being generally most complete early in the morning. Sometimes, however, the exacerbations come on towards evening, and last all night, the remissions being then most complete in the forenoon; while, in a few cases, there may be two exacerbations in the twenty-four hours; and these cases are generally the most severe. The exacerbation is usually marked by much cerebral affection, as severe headache, a painfully acute state of every sense, an injected state of the conjunctiva, and great action of the carotid arteries. The pulse, varying from 90 to 120, is generally at first full, but is sometimes from the first small, and generally soft and easily compressible. The tongue is dry, with a white and sometimes yellowish fur, and a bad taste in the mouth. There is generally unquenchable thirst, parched lips, tenderness at the epigastrium, and sometimes pain, with increased dullness on percussion, in the region of the liver. These symptoms are frequently accompanied by delirium, sometimes of a violent character. When giddiness is distressing, and proceeds to delirium at an early period, and runs high, a severe form of fever may be expected. In other cases the patient is oppressed with great drowsiness, lethargy, or coma. The stomach also is often the seat of great pain and uneasiness, followed by vomiting, and the matters vomitted are either colourless or bilious, or blood. The duration of this paroxysm varies considerably, and when the disease is mild it may terminate in six or seven hours; but if severe it may last fifteen, twenty-four, thirty-six, or even forty-eight hours; and Dr. John Hunter once saw a case in which there was no remission for seventy-two hours. Inability to sleep is almost constant. The urine is scanty, high-coloured, and of

high specific gravity (1024 to 1030), acid, not coagulable by heat (MURCHISON). Albumen was tested for by Dr. Murchison in numerous instances, but never detected; and according to Jones's experience in America it is very rarely present,—a point of difference, if verified, of great importance as a distinction between severe remittents and specific yellow fever (PARKES). In severe remittent fever Jones found the urea increased, and the uric acid lessened till convalescence, when it again increased, and the pigment was also lessened (PARKES, l. c., p. 242). The fever, however, at length remits, sometimes with sweating, but at other times without any sensible increase of perspiration. The first exacerbation is generally the longest, lasting, in some cases, for twenty-eight or twenty hours; but generally after twelve or sixteen hours the symptoms remit.

The duration of the remission which follows is as various as that of the hot stage. Sometimes it does not last longer than two or three hours; more commonly it extends to six, eight, ten, fifteen, thirty, or even thirty-six hours. The fever then returns, and in some cases assumes a quotidian type, and has an exacerbation every day, and perhaps nearly at the same time, yet more frequently there is no regularity in the times either of its accession or remission.

The second paroxysm is always more severe than the first, if the progress of the fever has not been checked during the remission, and usually neither any cold stage, rigor, nor even chilliness precedes it. On the other hand, all the febrile symptoms run much higher, the skin is hotter, the pulse more frequent, the headache greater, the senses more confused, and the delirium or coma, when that exists, more violent in degree and more sudden in its accession. Delirium with more or less loss of consciousness may not supervene till the third or fourth paroxysm; and is of a low wandering character in the asthenic form of the fever. The tongue becomes dry, hard, and brown, or almost black; the teeth covered with brownish scales; and the pulse becomes small and weak. These symptoms sometimes persevere with or without the black vomit, till they terminate perhaps in coma more or less profound, great prostration, *subsultus tendinum*, fetid breath, resembling the odour of a dead body, convulsions, and at length in death. The severe forms of the fever are sometimes accompanied with a yellowish

hue of the skin and white of the eyes. The yellowness is said to be less where there is a copious bilious diarrhœa, and where the urine is of a dark yellow-brown colour. When the disease does not terminate fatally, amendment is generally observed after the fifth exacerbation, which may subside in very copious perspiration, with the following symptoms of progressive amendment:—the tongue begins to clean and grow moist at the edges, the sordes disappear from the teeth, the thirst diminishes, and the appetite gradually returns. The pulse remains slow and soft, but begins to acquire strength; and the skin continues cool and moist; sleep returns, and the strength is gradually but very slowly recovered. Headache may continue for some days, till relieved by epistaxis. Young and robust men, particularly recruits, who recently arrive in India from Europe, suffer a considerable amount of vascular excitement, with marked symptoms of determination of blood, either to the head or to the abdominal viscera, at a very early stage of the fever. In such cases the pulse is at first full and of tolerable strength, the skin burning, and the delirium raging and acute. Again, in other men more advanced in years, or those debilitated by long service in India, by previous disease, or by habits of intemperance, there is very little vascular excitement, even during the exacerbations; and the pulse, though quick, is small and weak. There is no great heat in such cases—there is even coldness of the skin, with a yellow tinge, often severe hiccough and vomiting, with great prostration of all the vital powers. In such cases the chief indications of the exacerbations are increased restlessness, vomiting, headache, or wandering delirium. In these cases the remissions are not well marked, even from the commencement of the attack (MURCHISON, l. c.).

There are great varieties in the degree of severity and type of this fever, more especially as they occur in England, France, Holland, and Germany, compared with those which occur in Spain, Italy, the Mediterranean Islands; or still more so in Africa and the East and West Indies; and accordingly some authors distinguish (CRAIGIE) three varieties,—*e. g.*, (1.) The autumnal remittents of temperate countries, as England, France, Germany, Holland, Hungary. (2.) The summer and autumn remittents of warm countries, as Spain, Italy, Greece, the Mediterranean coasts and islands generally, the Levant, the north of Africa and Asia,

and the United States. (3.) The endemic remittents of hot and tropical climates, as in the south of Asia, Central and Western Africa, Equinoctial America, and the West India Islands. Accordingly remittent fever has received different names from the localities where it prevails. Thus we have the *gall sickness* of the Netherlands, the Walcheren fever, fever of the Levant (IRVINE), Mediterranean fever (BURNETT), Hungarian sickness, *puka fever* of the East Indies, *jungle fever*, *hill fever* of the East Indies, *bilious remittent* of the West Indies and Mediterranean, Bulam fever, Sierra Leone fever, fever of Fernando Po and Bight of Benin, African fever, Bengal fever. Prevailing on the borders of inland lakes, as in America, it is sometimes called the *lake fever*.

Treatment.—With fever so various in its degrees of severity it is not possible to do more than indicate the nature of the treatment which may be followed, as every special case must be prescribed for and treated by its own special indications, and with a due regard to the nature of the prevailing epidemic.

The extent to which blood-letting can be carried, as recommended by Drs. Irving and Cartan and Mr. Goodison, will depend on the constitution of the patient, the type of the fever, the season, the climate, its immediate effect, and whether the prevailing epidemic is of such a kind as to be benefited by blood-letting. From the testimony of Dr. Hennen as to Corfu, Mr. Muir as to Cephalonia, Mr. Goodison as to Zante, and Mr. Boyle as to Sierra Leone, those who have long resided in these places do not bear blood-letting so well as strangers from colder and more temperate regions. When blood-letting is beneficial its effect is in general to abate remarkably the pain, throbbing, and constriction of the head, and the pain of the orbits, to relieve epigastric oppression and tenderness, to render the pulse slower, less tense and oppressed, and to render the motion of the blood more free and less embarrassed. In some instances in which delirium is urgent, leeches applied to the occipital region are of the greatest benefit.

Local depletion over the epigastric region is often of great service, and enables the stomach to retain fluids and medicine. Purgatives are indicated to unload the alimentary canal, and to relieve the congestion of the visceral blood-vessels. The form most useful is the compound powder of jalap with calomel given

Condition of the Urine.—The observations made on the condition of the urine are divisible into two series, as arranged by Dr. Parkes (l. c., p. 235). (1.) The condition of the urine during the fit, as compared with the urine of a non-febrile period; (2.) The condition of the urine of twenty-four hours during a fever day, as compared with the twenty-four hours' urine of a non-fever day.

During the fit and the apyretic period the water of the urine is increased in amount during the cold and hot stages; it is most abundant at the termination of the cold or commencement of the hot stage. It decreases during the latter part of the hot stage slowly, and rapidly during the sweating stage. The amount of increase is variable, and stands in no relation to the quantity of fluid drank, and may be great when this is small (RINGER). The amount of urea excreted by a person with ague, not actually suffering from a fit, is less than in health; but directly the fit commences, that is, at the very first moment of elevation of temperature, or even for some time before this, the urea suddenly increases—an increase which lasts during the cold and hot stages, and then sinks, sometimes gradually, sometimes suddenly, through the sweating stage, or into the commencement of the intermission. It then falls below the healthy average. The amount of increase is very variable, and the type of the fever has no influence upon it; but there seems to be a very close connection between the temperature and the amount of urea. The amount corresponding to a degree of Fahrenheit was greater at a high than a low temperature; and in the fit of each day the same amount was excreted for each degree of temperature. (*Med.-Ch. Trans.*, 1859.) This increase in the urea must be regarded, in some measure at least, as an indication of increased metamorphosis; and the close relation to the febrile heat certainly implies that it owns only this source, and is not caused by elimination following previous retention (PARKES).

The uric acid is greatly increased during the fit; and after the fit there are often deposits of urates, either spontaneously or on the addition of a drop of acid, and it seems probable that the increase in the excretion of uric acid continues for some time after the paroxysm; and the enlargement of the spleen in connection with this great increase of uric acid is probably not fortuitous (RANKE). The influence of quinine in diminishing

the amount of uric acid in health is of interest in connection with its effect upon malaria, and with the condition of the spleen in malarious fever (RANKE, BOSSE). The chloride of sodium is increased during the cold and hot stages to a great degree (TRAUBE, RINGER).

The results are contradictory regarding the urine of a fever day, compared with the urine of a fever-free day. This may be explained to some extent by the relative duration of the fit, compared with the fever-free period; and great differences may arise from the comparative length of the apyretic period on the fever days; also from the severity or the reverse of the fit, and from the amount of food and drink able to be taken.

With respect to abnormal constituents, albumen is found during the fit in a considerable number of cases. Blood, in some quantity, and renal cylinders are seen about as frequently as albumen; and occasionally chronic Bright's disease is a consequence of ague (PARKES, l. c.).

Treatment.—The treatment of agues varies in a great degree with the complications of the disease; such as the splenic and hepatic congestions, and the inflammatory affections of these and other organs, which are apt to be established during the existence of an intermittent fever. During each paroxysm, and subsequent to it, the condition of the two important organs referred to ought to be carefully observed; and it ought to be observed, also, whether any symptoms exist of congestion or actual exudation into the cranial or abdominal organs generally. When the type of the fever is malignant, or of a severe and complex kind, or when the complications are locally severe, it is difficult to cure an ague, which otherwise is a very manageable disease. During the cold stage, especially if it is of long duration, the liver, and especially the spleen, become turgid, the symptoms of which generally disappear with the sweating stage of the fever. It is when the endemic influences are severe, or when the attacks are prolonged over months and years, that these organs begin to suffer permanently from organic disease.

It is useless to attempt the cure of intermittent fever if the sufferer is permitted to remain within the sphere of malarial influences, or even in those geographical latitudes which may be said to be peculiarly malarial. It is now an established fact that none can become acclimated so as to withstand the influence of

application of leeches to the epigastric region, if any oppression or uneasiness exist there, or behind the ears if headache persist. A mixture composed of *antimonial wine* with the *acetate* or *nitrate of potash* should be given every two hours, so as to soften the skin and determine increased action of the kidneys. By these measures the daily decline of the disease is seen, and consequently there is a daily diminishing occasion for the use of active measures of cure, till towards the fifth, sixth, or ninth day convalescence is established.

If, however, remittent fever has existed unrestrained for several days, and the patient has not been seen till the accession of the third or fourth paroxysm, or even later, a general blood-letting is still the principal means of saving life, *provided the general powers of the constitution remain uninjured*; and it is to be followed by calomel, purgatives, and quinine, in the manner already indicated.

If the paroxysms have become indistinct, running into each other, with brief or ill-defined intervals, while abdominal or cerebral complications arise, as indicated by epigastric fullness, or by approaching stupor or delirium, *blood-letting* may even now constitute the principal means to save life; but the blood *must be still more gradually abstracted* than before, whether generally or locally. Generally speaking, it is to be done by leeches, at the accession of the paroxysm. *Antimonials* are also to be used—cold must be applied to the shaved head; and while sinapisms and blisters must also be applied, on the influence of calomel chief reliance is to be placed, and the very first dawn of remission is to be seized upon to give quinine. We are not, in such cases, to wait for a clean tongue, the absence of heat of skin, or local complication. It must be given every *three* or *four* hours, with an occasional mild aperient in the intervals, until the dangerous symptoms shall have yielded—a result often observed to be coincident with the manifestations of the mercurial influence. Dangerous symptoms, such as those just noticed, will sometimes rise suddenly without any loss of time on the part of the medical attendant or neglect in treatment. If such symptoms are associated with yellowness of the skin, in persons broken in health or of feeble constitution, or of dissipated habits of life, or who may have undergone much mental distress, the chances of a fatal termination are imminent.

When the spleen is enlarged, mercury is not to be used in the treatment of the fever; and blood-letting, either general or local, is not borne well. The blood is changed in such cases; it is more or less dissolved, and a general cachexia prevails.

The period of convalescence demands no less careful attention on the part of the medical attendant, especially as to diet and a timely removal from all malarious influences, by a voyage to sea or a change of climate. It is to the mismanagement of convalescence, and a too early discharge from hospital principally, that we must refer the numerous and fatal relapses in the fevers and dysenteries of our seamen and soldiers (MARTIN).

Regarding the method of treatment just described, my friend and colleague, Professor Maclean, writes me in the following terms:—

"I have been led," he remarks, "to take a view of the treatment of remittent fevers, differing in some important particulars from that laid down by Martin and those who think with him. It appears to me that he and others have been led to treat this malarial fever as if it were an inflammation. There is no doubt great disturbance both of the vascular and nervous systems; and a young physician coming for the first time to the bed-side of a patient during the exacerbation of a remittent fever, would naturally suppose his patient lost, or at all events that irreparable mischief would be done to the organs most exposed to this 'tempest of the frame,' unless something is done in the way of antiphlogistic treatment to reduce the force and frequency of the heart's action. But I am quite satisfied that the guiding principle of treatment in this, as in every form of malarial fever, is to counteract the poison, to prevent the recurring paroxysm; this done, the alarming symptoms subside, and the patient's constitution is not impaired by treatment in addition to the injury it has sustained from the action of the malarial poison. By keeping this principle in view the period of convalescence is greatly shortened. For the last twelve years and more I have never used lancet or leech in the treatment of any form of malarial fever.

"It is always, of course, advisable to have the bowels thoroughly evacuated; and if the patient is seen when his stomach is loaded, it is well to evacuate its contents by an emetic. In ardent remittents, however, there is generally little call for this, as obstinate vomiting is almost always a troublesome symptom. This done, the period of remission must be watched for, and the moment it arrives quinine in a *full dose* should be given—not less than fifteen grains in the case of an adult. If the irritability of stomach be so urgent that the remedy is rejected,

while measures must be adopted to allay it, such, for example, as alkaline remedies in combination with hydrocyanic acid, turpentine stupes, or even a blister to the epigastrium, time—precious time—should not be lost. *Quinine* should be given *by the rectum in a full and efficient dose*. By mouth or by rectum, or by both, quinine in quantity sufficient to induce some of the symptoms of saturation (cinchonism), should be given before the time of expected exacerbation. According to my judgment and experience it is bad practice to withhold quinine until an impression has been made on the force and frequency of the heart's action, from fear of increasing headache, causing congestion of organs, or the like. The impression on the force and frequency of the heart's action is best attained by arresting the paroxysm; and this is done most quickly, simply, and effectively by the early administration of quinine. I have over and over again had patients brought to me from the malarial quarters of the city of Hyderabad, in whom it was impossible to distinguish any period of remission—the tongue black and dry, sordes on the teeth, the skin hot and dry, the pulse enormously quick, the intelligence feeble or gone—all pointing to a system so charged with malarial poison as to be well-nigh overwhelmed. In such cases quinine, with concentrated beef-tea and brandy, are urgently called for, and should be administered freely; and it is astonishing how men, by such energetic measures, are often snatched from impending death. I have seen in a few hours consciousness return, a striking reduction in temperature, in the *frequency* of the pulse, with a remarkable accession of force and volume, from the treatment indicated above. I do not advise, and never used quinine in the heroic doses advised by some; I have never exceeded a ʒ; but within such reasonable limits I have never seen it aggravate headache. On the contrary, I believe that in remittent fever—in fact, in all forms of malarial fever with which I am acquainted—I believe quinine to be a powerful remedy in quieting the tumultuous action of the circulation disturbed by the presence of this terrestrial poison. For some years past Warburgh's tincture has been much used in the treatment of malarial fevers in Southern India. It is a secret remedy, and therefore open to the objections very properly urged against all such remedies. It is understood that quinine enters largely into this remedy, and I do not doubt it. Be this as it may, I have given this 'tincture' a fair trial in some of the gravest forms of malarial fever, and it has also been extensively used by some of the most experienced officers of the Madras army; and I do not hesitate to say that I think it a valuable remedy. I have known it arrest at once some of the severest cases of remittent fever, no exacerbation appearing after the second dose. It almost invariably acts as a powerful diaphoretic—the most powerful with which I am acquainted. I have seen patients satu-

rate not only the bed-clothes but the very mattress and the bedding, the patient's room and his person for days after giving out a strong odour of the medicine. For this reason it requires to be used with extreme caution, if at all, in the adynamic form of the disease. In urgent cases I follow the practice of the American physicians. I do not wait for a remission, but give the quinine at once; and in all I am conservative of the patient's strength. I have seen violent delirium follow free leeching of the temples, and over and over again seen extreme and dangerous prostration follow depletive treatment, and that in cases where the violence of the disturbance indicated *power*; but these signs of power in the system are often most delusive, and if combated by depressing measures, we must be prepared for sudden signs of collapse. Against the system of treating this fever by saturating the system with mercury I enter my strenuous protest. I know nothing more deplorable than the condition of a patient whose constitution, already depressed by the presence of this depressing poison (malaria), is further saturated by another, which acts as a powerful ally of the first."

In the asthenic form of remittent fever, such as that so well described by Dr. Murchison as prevailing in Burmah, it is necessary to exercise great caution in depletion. All the cases he relates which had been freely bled exhibited the most aggravated typhoid symptoms, and most of them died. Even in the instance of young and robust recruits low adynamic typhoid symptoms were sure to supervene in a short time after blood-letting; and even although it gave temporary relief it was certain to aggravate if not to induce the subsequent typhoid condition. If the headache is very severe and the pulse full, a few leeches may be applied to the temples at the commencement of the attack; but if the hair be cut short or shaved off the scalp, cold lotions applied to the head, or the cold douche kept up for ten minutes at a time, gives great relief, and is the preferable remedy (MURCHISON). As soon as possible after the commencement of the paroxysm the bowels should be cleaned out with a purgative of calomel and compound jalap powder; or by colocynth, antimonial powder, and calomel. If typhoid symptoms betray themselves, stimulants, such as wine and brandy, must be given; but, as in intermittent fever, "quinine is undoubtedly the sheet-anchor," and it is best given, as in the former fever, in one large dose of twenty grains at the very commencement of a remission.

*Relative Mortality of Remittent Fever at the Foreign Stations of the
British Army, by Sir Alexander Tulloch.*

STATIONS.	Period of Observation.	Aggregate Strength.	Number Attacked.	Died.	Proportion of Deaths to Admissions.
Windward and Leeward command, {	20 years.	86661	17799	1966	1 in 9
Jamaica,	20 "	51567	38393	5114	1,, 8
Gibraltar,	19 "	60269	{ *y. f. 314	28	1,, 11
Malta,	20 "	40826	1522	423	1,, 3½
Ionian Islands,	20 "	70293	384	16	1,, 24
Bermudas,	20 "	11721	6934	623	1,, 11
Nova Scotia and {	20 "	46442	{ *y. f. 19	6	1,, 3
New Brunswick, {	20 "	46442	277	101	1,, 2½
Canada,	20 "	64280	15	—	1,, 15
Western Africa,	18 "	1843	294	18	1,, 16
Cape of Good Hope,	19 "	22714	1601	739	1,, 2
St. Helena,	9 "	8973	15	1	1,, 15
Mauritius,	19 "	30515	25	1	1,, 25
Ceylon,	20 "	42978	6	1	1,, 6
Tenasserim Provinces,	10 "	6818	4643	868	1,, 5½
Madras,	5 "	31627	594	22	1,, 27
Bengal,	5 "	38136	1139	54	1,, 21
Bombay,	5 "	17612	1311	89	1,, 14½
			2854	114	1,, 25

MALARIOUS YELLOW FEVER—*Febris Icterodes Remittent.*

Definition.—*Febrile phenomena due to malaria, in which the exacerbation and remission are so connected that the fever resembles a continued fever, and is characterized by great intensity of headache, yellowness of the skin, and black vomit (COPLAND, DICKENSON, BOOTT); but in which the urine is not suppressed, and continues free from blood or albumen.*

Pathology.—It immediately results from the history of yellow fever, that in its malarious form it is the product of the coasts of the West India Islands, the American equinoctial continents, several districts in Spain, and the west coast of Africa. All over the Caribbean Sea the disease takes place sporadically, or in insulated cases every season, more or less numerous, according to the subjects and the number of new visitors, and there never is a season in which a few cases do not occur. At Vera Cruz, Havanna, and other towns on the Spanish Main, malarious yellow fever invariably attacks Europeans or Canadians who may land there between the months of May or June, and October or

* y. f., yellow fever prevalent.

November; but so long as such cases continue few, isolated, and sporadic, they attract no attention, and the disease is not heard of in ordinary years. It seems to prevail, for the most part, in towns situated on the sea or river coasts of alluvial countries in warm climates; and that, while the banks of these rivers or seas are liable to occasional alternate periods of inundation and drying up, the fluctuations of the tides, co-operating with these, contribute powerfully, under intense solar heat and a windless atmosphere, to render the towns along the shores of such districts the seat of malarious yellow fever. "While ague is the offspring of the marsh or its margins, and remittent is the effect of a more concentrated form of the same exhalation from some moist surface in the process of solar desiccation, the malarious form of yellow fever appears to be the product of that state of the atmosphere which takes place after a long continuance of solar heat, with little or no wind, in those points chiefly where the atmosphere of the sea and that of the land are in constant communication and interchange. It is, indeed, a remarkable fact that the intense form of remittent fever, which has been distinguished as malarious yellow fever, and sometimes as "bilious remittent of malignant type," is rather rare in the interior of countries, and is seldom found in towns even situate on rivers higher than the influx of the tide. The fevers which appear in these situations are more of the usual remittent character; and in the interior of the American continent there is little doubt that the *lake fever* represents the *yellow fever* of the coasts. Even in Europe, while the towns on the sea-coast and on rivers were labouring under the specific epidemic yellow fever, the sickliness in the interior approached more to that of the remittent or remittent continuous type" (CRAIGIE). For this reason the term *litoral* as well as *paludal* is used to designate this class of fevers.

The endemic conditions under which the malaria give rise to this form of yellow fever might be referred,—(1.) To thermometric temperature of the air; (2.) To the state of the atmosphere as to currents of winds and electricity; (3.) Local peculiarities of surface already referred to; (4.) Constitutional susceptibility, and crowding together of masses of people.

That intense solar heat contributes greatly to the development of the yellow form of malarious fever, is shown by the situations of those parts where it is peculiarly endemic, in relation to the

prevailing temperature. Thus, it is found to prevail chiefly in places situated in the eastern regions between 10° of south latitude and 42° of north latitude. On the continent of Europe it has generally prevailed in places situated between the 36° and 38° north latitude, and has never gone farther north than Barcelona on land, or in latitude 48° north on the sea. That it has gone farther north, it has been alleged, but the authenticity of the statement is doubted. In these northern latitudes it is also observed that the malaria of yellow fever cannot pass over a thousand yards of water without being deprived of its power.

The following observation was made by Sir John Pringle on the fevers of Walcheren and South Beveland in 1747:—

“These epidemic fevers, by reason of the great heats of the season, not only began more early than usual, but were fully as fatal to the natives as to us. But Commodore Mitchell’s squadron, which lay all this time at anchor in the channel between South Beveland and Walcheren, in both of which places the distempers raged, was neither afflicted with fever nor flux, but amid all that sickness enjoyed perfect health; a proof,” he says, “that the moist and putrid air of the marshes was dissipated or corrected before it could reach them.” (*Diseases of the Army*, p. 58.)

The very same observation was made at the very same spot, fifty-two years afterward, by Sir Gilbert Blane:—

“I had, in the course of this service (at Walcheren, in 1809), an opportunity of observing the extent to which the noxious exhalations extended, which was found to be less than I believe is generally known. Not only the crews of the ships in the Road of Flushing were entirely free from this endemic, but also the guard ships stationed in the narrow channel between this island and South Beveland. The width of this channel is about six thousand feet; and although some of the ships lay much nearer to the one shore than the other, there was no instance of any of their officers or crew being taken ill with the same disorder as that with which the troops on shore were affected.” (*Med.-Chir. Trans.*, vol. iii., p. 27.)

It is now also generally believed that the malarious form of yellow fever cannot exist, except in places where the average range of temperature is high throughout a considerable part of the year; and for this reason it is believed that it will not become a disease of this country. Sir Gilbert Blane asserted that it never appeared either in tropical climates or in the temperate

latitudes, unless when the atmospheric heat has been for some time steadily at or above 80° Fahr., 21° of Reaumur, or 26°·67 Cent.; according to Humboldt, 75° of Fahr., or 24° Cent.; and according to Matthei, 72° Fahr., or more. The disease is also found not to prevail in mountainous situations. According to Humboldt it has never ascended to 3,044 feet above the level of the sea, and according to Sir Ranald Martin never above 2,500 feet; and below the former limit the Mexican oaks do not flourish, showing that the constant average temperature below this is of a tropical character. In Jamaica, according to Dr. Craigie, it rarely ascends 1,600 feet above the level of the sea (Dr. Lawson's instance of the outbreak at Newcastle being considered an instance of "specific yellow fever"). "In Jamaica the medium temperature of Spanish Town in the hottest months is about 85° Fahr., or between 83° and 85°; and in Kingston it is much the same, ranging from 85° to 90°, and rarely falling below 80°, from May to the end of September. At the more elevated parts, however, the temperature diminishes, being only about 70° at Stoney Hill, elevated about 1,300 feet; at Cold Spring, 4,200 feet above the level of the sea, only 60°; and at the summit of the Blue Mountains, which are estimated to be 7,200 feet above the level of the sea, the thermometer is found to range in August from 47° at sunrise to 58° (HUNTER) at noon, or at an average of 60° (MOSELEY).

At Stoney Hill, the first of these places, yellow fever has sometimes, though not very often, displayed its epidemic virulence in a very bad form.

In the island of Trinidad, however, the ridge behind Port of Spain, which is a limestone rock elevated 1,500 feet above the level of the sea, has been highly productive of yellow fever, and has cost the lives of many men in attempting its clearing and fortification.

The composition of the soil has been believed to exercise some considerable influence on the production of malarious yellow fever. On this subject, however, the facts are discordant. Alluvial soils are those where malarious yellow fevers have mostly prevailed, as at Granada, St. Domingo, New Orleans, Philadelphia, New York, Boston; or calcareous, as in Jamaica; it has also been observed that a beach, bank, quay, or wharf is the place where the disease first makes its appearance, when such beach, bank, quay, or wharf is alternately immersed in sea water and exposed

to the drying effects of great solar heat. The drying effects of great solar heat have also been supposed to extricate some deleterious material from the green wood of new ships (WILSON), and also from forests of mangroves (INGRAM, HUMBOLDT, WILSON).

In all those localities where the disease is endemic, it seems to manifest a decided preference for the natives of the colder regions. Thus the British, Germans, Swedes, Danes, are more liable to suffer than Italians, French, or Spaniards; and in ordinary years the natives, and especially the coloured population, are rarely attacked.

The diagnosis between the specific contagious yellow fever and the malarious form of yellow fever is at all times difficult; and severe marsh fevers in certain geographical limits have a close resemblance to contagious yellow fever. But they are not contagious, and urinary and blood symptoms do not occur in them. It must also be remembered, in accounting for its origin in any case, that marsh fevers have become developed weeks and even months after exposure to the exciting cause.

With regard to the further history of the phenomena and treatment of this form of fever, the reader is referred again to what is said under remittent fever, and simply stating that when an observer has seen only the milder form of marsh remittent fever, and is then suddenly called upon to witness an attack of malarious yellow fever, he may well believe that the affections are entirely distinct. But, after a time, when the intermediate forms have been more closely scrutinized, it is found that at no point can any valid line of demarcation be drawn between the several forms of these malarious fevers, so numerous are the connecting links which bind them to each other (ALISON, PARKES).

SECTION IV.—MUCOUS FEVERS.

Under this heading it is proposed to group together and to consider the remaining diseases of the *miasmatic* order which are to be noticed in this text-book. These are,—*Influenza*, *Whooping-cough*, *Diphtheria*, *Croup*, *Dysentery*, *Diarrhœa*, *Cholera*.

These diseases are all attended with fever, and are characterized by irritations, specific lesions, or altered functions of some

portion of the mucous membrane, either of the respiratory or alimentary tracts.

INFLUENZA—*Influenza*.

Definition.—*A specific febrile disease, invariable in its essential characteristics, frequently prevailing as an epidemic, attended with lassitude and prostration to an extreme degree; chills and great sensibility to cold over the surface of the skin, the eyes injected and tending to fill with tears, the nostrils discharging an acrid fluid, attended with fixed and intense pain in the head, mostly frontal over the eyes, sometimes also attended with giddiness; nights sleepless, with delirium, or lethargy; cough prevails, with yellow expectoration, most troublesome at night, and tending greatly to increase the headache. Fever attends the disorder, sometimes slight and sometimes severe, and of a type varying in different epidemics and localities. The sense of taste is generally greatly disordered, and there is great anxiety and oppression over the region of the heart.*

Historical Notice.—We have no credible accounts of the existence of influenza previous to the tenth century. In 1311 it was very fatal throughout all France. In 1403 the courts of law in Paris were closed on account of the deaths. Towards the close of the twelfth and thirteenth centuries it was observed that catarrh was not only endemic in particular districts, but that it occasionally spread over large portions of country, while still later, in the year 1557, it was found to prevail epidemically, not only over the whole of Europe, but even over the whole of the northern hemisphere, beginning in Asia and proceeding westward till it terminated in America. In the eighteenth century, having advanced westward till it reached the Elbe, it passed over the intermediate countries and reached England, where the stream broke into two branches: the one crossing the Atlantic to America, while the other retrograded south-east through France, Spain, and Italy, till it was lost in the Mediterranean—a course similar to that described by cholera.

Influenza has occasionally originated as far eastward as India, but more commonly it has broken out in the north of Europe, as Moscow, Warsaw, or Dresden. It seems probable that, like the poison of Cholera Indica, its spread may be limited to a small number of primary foci; for we find, in every volume of the

Calcutta Transactions, accounts of some catarrhal fever spreading for a season along the banks of some principal river, and then subsiding; so that it is evidently only occasionally and at long intervals *erratic*, as in 1729, 1743, 1775, 1782, 1831, 1833, and 1837. The influenza, therefore, is both endemic and epidemic; and, in the latter case, we find it, at least in Europe, spreading from east to west, prevailing in the depths of winter as well as the heights of summer, lasting nearly the same space of time in the different towns and cities it attacks, or from four to six weeks, affecting contiguous places in different degrees and at different times.

On looking to the habits of this poison, it is probable that its actions are not limited to man; for in most years, when influenza has been epidemic, a similar disease has been epizootic, especially among horses and dogs, as in the years 1728, 1732, and 1775. It is a disease of extraordinary rapidity of progress; and as its diffusibility is great, so are its periods of recurrence frequent—those cycles of its visitation which are as yet beyond our comprehension to explain.

Pathology.—A specific poison is believed to be absorbed and to infect the blood, when, after a given period of latency, it produces disordered functions of the great nervous centres, causing great general depression, extreme debility, together with slight or severe remittent fever. The specific actions of this poison are on the mucous membrane of the eyes, of the nose, and of the bronchi. In a smaller number of cases on the mucous membrane of the fauces, causing sore throat, and in a still smaller ratio on the substance of the lungs, and on the pleura, causing inflammation of those organs. In most instances the disorder terminates in diarrhœa. These different pathological phenomena vary in frequency and complexity in different seasons and places.

In most cases, when the poison is of sufficient intensity to produce fever, the type is remittent in this country, with exacerbations in the evening. Its usual duration is two, three, or four days, when it terminates in an abundant sweat, and which not unfrequently leaves great debility behind it. In Germany the fever is sometimes intermittent. At the same time, however, or it may be preceding or succeeding the fever, the patient has in general been seized with a slight inflammation of the ocular and nasal membranes, followed by coryza, or the serous discharge

of a common cold or catarrh; and this inflammation generally extends to the larynx and trachea, or to the lungs.

The pneumonia occupied most commonly the middle and lower lobes, and only rarely the summits of the lungs. Out of forty cases observed by M. Landau, the inflammation occupied twenty-one times both lungs, eleven times the right lung, and eight times the left. The forms of pneumonia are principally serous inflammation and red hepatization, the latter occasionally interspersed with a few points of pus. Gluge states that in the fatal cases of pneumonia connected with influenza he has found exudations in the bronchia, which he can only compare to the false membrane of croup. Such exudations were seen in the hepatized portions of the lung as white elastic firm cylinders filling the bronchia, from the fourth or fifth divisions of these tubes, into such as are not more than a quarter of a line in diameter. The inner membrane of the bronchia in such cases was extremely reddened, but not softened.

Symptoms, Course, and Complications.—The symptoms of influenza assume a variety of different forms. Thus, catarrh often exists without the fever, and, in a smaller number of cases, the fever without the catarrh. Severe nervous depression, prostration, anxiety, and præcordial oppression, were frequently the most prominent symptoms, while in other instances the bronchial affection alone harassed the patient.

The disease usually begins suddenly with chilliness and shivering, rapidly succeeded by an immediate and evident impression upon the mucous membranes of the nose, mouth, frontal sinuses, trachea, and bronchial tubes, to a greater or less extent. General soreness accompanies these symptoms, with severe darting neuralgic headaches, aching of the limbs, listlessness, great mental depression, complete anorexia, and an extraordinary weakness, which, in the experience of Dr. Parkes, bore a close ratio to the extent of the pulmonary affection, and consequently to the severity of the disease. These symptoms were accompanied by fever, slightly increased towards evening. Patients were usually seen about the third or fourth day, and then they were found complaining of cough, tightness of the chest, of pain in the epigastrium, and also of dyspnoea. The face was flushed, and sometimes swollen, the alæ of the nose red, the lip vesiculated, the eyes streaming with coryza, and the voice altered as in a common cold.

The tongue was moist, or coated with a yellow mucus, and taste was vitiated, the skin soft, and without morbid heat, the pulse little augmented in frequency. But although each of the particular symptoms might be mild, there was a languor, debility, and dejection of spirits far beyond what might have been expected, and almost exceeding that of common continued fever. These symptoms were, in many instances, long in subsiding. The average duration of the cases in the epidemic of 1847, so admirably described by Dr. Peacock, was from three to five days in the mild forms; and from seven to ten in the more severe.

In mild cases such phenomena constituted the whole disease, and the patients recovered about the eighth or tenth day, after suffering for a few hours from sharp diarrhœa. In many instances, however, the patient, in addition, suffered from mild or severe sore throat, or cough came on and continued for many weeks. In a few cases the symptoms were of a more aggravated character, the fever being more marked, the pulse accelerated, the skin hotter, and the cough more troublesome; and these conditions have often been followed by inflammation of the lungs.

The pulmonary complications may be arranged into four forms,—(1.) Capillary bronchitis; (2.) Bronchitis supervening on tuberculous disease of the lungs; (3.) Bronchitis with disease of the heart or aorta; (4.) Pneumonia.

The accession of capillary bronchitis is indicated by the chest symptoms becoming more severe and the cough paroxysmal, and the dyspnœa at first quite disproportionate to the cough and to the physical signs. The expectoration is scanty, and consists of small yellowish pellets, forming tenacious masses of a peculiarly nodulated form. The pulse becomes rapid (120—140), the tongue covered with a white-brown fur, and prostration is extreme. The only auscultatory signs are roughness of the inspiratory murmur, with occasional sibilus, and slight crepitation at the back. There is soreness and contraction of the chest, but no acute pain. Crepitation, unattended by dullness on percussion, soon extends over a greater or less extent of both lungs; and the dyspnœa speedily becomes so intense as to prevent the patient from lying down, the lividity of the lips and face increases, and the eyes become prominent. The cough is now very frequent, the sputa very viscid, of a greenish-yellow colour, without air-bells, and often streaked with blood. The respirations are

quickened; but there does not appear to be any uniform connection between the extent of the disease and the disturbed ratio of the pulse and respiration movements. The general rule is, that the respirations are relatively more quickened than the pulse (PEACOCK, PARKES). The physical signs soon become modified by rapidly developed emphysema of the lungs. Generally, it may be said that the *capillary bronchitis* of *Influenza* is distinguished from *pneumonia* by the greater severity of the general symptoms; by the tendency of the fine crepitation of the early stage to pass into subcrepitant and mucous râles, rather than to give place to evidences of condensation, and by the peculiar characters of the cough, which is paroxysmal, and not attended by pain; and, lastly, by the character of the expectoration, which consists of whitish viscid pellets, cohering into irregular masses, and destitute of the glairy adhesive character, russet colour, and small air-bubbles of pneumonia expectoration (PEACOCK).

Inflammation of the substance of the lungs seldom occurs till the second or third day, and more commonly not till the fifth or sixth; and, although generally, is not always preceded by shivering, or even bronchitis. The pneumonia in some years has been characterized by well-marked symptoms, as pain in the side, dyspnoea, and by purulent or sanguineous expectoration, so that nobody could mistake it; but in general the pneumonia has been adynamic in character, and presented a striking contrast to the usual symptoms, there being scarcely any local pain, the pulse, ordinarily so large and full, has been slow and small, and though sometimes counted between eighty and ninety, has ranged more commonly from sixty to seventy. The face also, instead of being full and red, has been sharp and pale, the lips blue, and the extremities cold. The patients also, who generally preserve a good deal of power in the ordinary forms of pneumonia, were now so weak that they were obliged to be supported while auscultated; and even this mode of exploring the chest did not afford the usual indications, for crepitation was rare, and the respiratory murmur heard, except in a few points, all over the chest, while there was little or no bronchophony. The auscultatory signs are in general those simply of bronchitis, dry rhonchus in some parts, and harsh vesicular murmur in others. The expectoration likewise had not the characters observed in simple pneumonia; for,

instead of being purulent and mixed with blood, it was thin, transparent, and viscid, and, if fever accompanied it, it was usually of an andynamic character, marked by a brown tongue, an accelerated pulse, and occasionally by delirium. Throughout the progress of this disease the symptoms of nervous derangement are much more prominent than in ordinary catarrh, and the muscular debility is great, which is the most distinguishing feature of the disease. So great is this prostration, that in some instances the patient has fainted merely by attempting to sit up. This extreme debility often continues after all other symptoms have passed away. The disease generally terminates favourably by perspiration, or by a copious secretion of mucus from the bronchia, or a copious discharge of urine, which deposits a sediment on cooling. Towards the termination of the complaint, rheumatic affections, especially of the face and head, assume an intermittent type.

Causes and Modes of Propagation.—The attack of influenza is for the most part so universal that large portions of the population of every country in which it has prevailed, without respect to age, sex, or condition, have been commonly infected. In general, however, women, from being less exposed to the weather, have suffered in a smaller proportion than men, and children less than either. In all of these epidemics the aged suffer greatly. According to Dr. Blakiston's results, the ages from ten to sixty furnish the most patients. The age from thirty to forty furnish most males, and from twenty to thirty most females. In the epidemic of 1847 the mortality was greatest amongst the adults and aged. In childhood the average mortality was raised 83 *per cent.*; in manhood, 104 *per cent.*; and in old age, 247 *per cent.*

It has been remarked in several epidemics that the low parts of towns have been more generally and more severely affected than the higher and more healthy districts. The epidemic of 1847 was much more fatal in the insalubrious parts of London than in those less unhealthy; and according to Dr. Peacock's experience, the mortality of influenza was owing more to the condition in which the disease found the patient, than to any inherent power of the poison itself—a result conformable to general experience and the returns of the Registrar-General (PARKES).

The nature of the "*epidemic influence*" which gives rise to *influenza* is quite unknown.

Sudden changes of temperature appear to assist the development of the influenza poison; and exposure to cold predisposes the individual to the disease—which seems to be a disease especially of the higher latitudes.

Susceptibility Exhausted.—Few persons suffer more than one attack of influenza in the same epidemic, although many relapse; but one attack of this disease in no degree protects the constitution from a second attack in another epidemic.

Prognosis.—Children and persons under forty died in a very small proportion, unless in a previous state of ill-health. The mortality, however, among the aged has in every country been great from this disease. It has been remarked, also, that the disease, if not fatal in itself, left the patient, of whatever age, often greatly debilitated in body and depressed in spirits, and that those with tender lungs who suffered from it frequently fell into phthisis, or continued to cough for several months afterwards, so that a complete recovery was often long and tedious.

Treatment.—As a general rule, the great majority of cases in epidemics of influenza have scarcely required any medical treatment. In that of 1782 it was observed that “many, indeed, were so slightly indisposed as to require little or no medicine; nothing more was wanted to their cure than to abstain for two or three days from animal food and fermented liquors, and to use some soft, diluted, tepid drink. A lenient purgative at the beginning of the disease was useful in moderating the fever, and nature seemed to point out the repetition of it afterwards when there was pain in the stomach and bowels, and a tendency to diarrhoea. The same was observed in 1762. Nothing, likewise, was observed so successfully to mitigate the cough as a gentle purge to open the bowels, and afterwards to give a gentle opiate at night. In the year 1837 it was also remarked, as long as the symptoms were limited to cough, hoarseness, headache, or other pains moderate in degree, that the patients all recovered by putting them on a low diet, by attending to their bowels, and confining them for a few days to the house; and if more was attempted it was quickly found that the disease ran a course scarcely influenced by medicine. A smaller number, however, required medical attendance, either from the severity of the bronchitis, the occurrence of pneumonia, of angina or severe dyspnoea, of the disordered state

of the bowels, or more frequently from the debility induced by the disorder.

In general, when the bronchitis was severe, but the substance of the lung as yet unaffected, leeches to the chest, or cupping, or moderate bleeding, were borne extremely well, and the patient relieved; while in the aged, blisters to the chest, followed by a series of lintseed poultices, were often of essential service; and this treatment, together with neutral salts, opiates, and diaphoretics, in general effected the cure. In all the great epidemics of influenza, however, it has been remarked that the whole class of expectorants were either useless or uncertain in their action.

In the epidemic of 1847 Dr. Peacock found blood-letting of little use, except in the very early stage. It increased prostration, without benefiting in any commensurate degree the pulmonary disease. Leeches, however, were sometimes useful, and counter-irritation of various kinds. An antimonial emetic was generally given at the commencement. During convalescence *sulphate of zinc* was found to be a useful tonic when the expectoration was thin and spumous, and alkalies more useful when it was viscid and glairy (PEACOCK).

In pneumonia it has been found that although a few persons bore the loss of a considerable amount of blood, yet, in general, blood taken beyond a very limited quantity either did not relieve the complaint, or the practice was actually prejudicial. It is in this form of pneumonia that large doses of the *tartrate of antimony* have been found so advantageous. Indeed, it seems distinctly proved that this form of pneumonia will not bear that powerful antiphlogistic treatment which is necessary when it arises from general causes, and is of a more sthenic character.

When the patient was affected with angina, it yielded readily to small bleedings when the tonsils were swollen, and to small quantities of wine when the tonsils presented little or no increase of size. The derangement of the bowels also readily yielded to purgative medicines when constipated, and when affected by diarrhoea and accompanied by pain, to mild purgatives and opiates, or to the compound powder of chalk with opium.

When the fever and other immediately alarming symptoms of the influenza had ceased, there frequently remained a teasing cough, and the convalescents in general complained of languor, want of appetite, and that their sleep was broken and unrefresh-

ing. For removing these complaints, change of air and riding on horseback were most effectual, and to some they were absolutely necessary; and in addition to these, mild tonics, or the natural chalybeate waters drank at the spas were of singular service. In slight cases it was sufficient to limit the patient to white fish and puddings, and in the severe forms to slops and light puddings. The night air was universally prejudicial. It does not appear that any precautionary treatment was of service in preventing the spread of this disease among the attendants on the sick; for when four-fifths of the population were labouring under the disease, it can hardly be considered as having spread by contagion.

WHOOPING-COUGH—*Pertussis*.

Definition.—*An infectious and sometimes epidemic specific disease, preceded and accompanied by fever of variable intensity; attended in the first instance by catarrh, and subsequently by paroxysmal fits of coughing, which occur in numerous short, rapid, spasmodic, convulsive movements of expiration, suddenly followed by a prolonged inspiration, marked by a characteristic sound of a sonorous kind, and variously named the "kink," "hoop," or "whoop." These paroxysms of expiratory and respiratory convulsive movements alternately recur several times, till the fit ends by a quantity of mucus being brought up from the lungs, or till the contents of the stomach are evacuated.*

Pathology and Morbid Anatomy.—The theory of this disease is, that a specific morbid poison produces slight primary fever, which for the most part subsides on specific or secondary actions being established. These are catarrh, followed by a peculiar cough and vomiting, due to irritation of the *vagus nerve* by the specific poison.

Very different opinions have, however, at various periods been entertained as to the nature of this disease. Its origin appears to have been comparatively of no very distant date, Sprengel not having been able to trace it beyond 1510, when it was endemic in Paris; but its epidemic character was not determined till 1580, when it destroyed a prodigious number of children throughout Europe. The disease prevails occasionally all over the world. It is sometimes fatal to a large proportion of children; and, like other diseases of this class, it appears, as a rule, but once during life, and

attacks chiefly infants and children. Dr. Watson gives an instance of a child born with whooping-cough. There are instances, however, of its occurring not only late in life, but also a second time (HEBERDEN). Some consider the disease simply as a variety of *bronchitis*, and accordingly class the disease with inflammatory disorders of the bronco-pulmonary mucous membrane. Inflammation, however, is not necessarily found to accompany the disease, although a state of the mucous membrane exists, by which it is morbidly irritable, or susceptible to impressions. Many cases have been examined in which no trace of inflammation or other morbid change has been discovered in any part of the body. If, however, the disease be of great intensity, it very commonly produces structural changes in the lungs, stomach, intestinal canal, or the membranes of the brain.

Rostan says, "I have examined some children that have died of this disease, with great care, and I have constantly found alteration of structure of the respiratory organs. The most common of these alterations is peripneumony, either single or double, with pleurisy and catarrhal inflammation of the bronchial membrane." Emphysema of the lungs has also been observed.

Dr. Watt, on examining the body of his son, Robert Watt, found that, "on laying open the stomach, the internal surface had numerous red streaks, the marks of inflammation. There was also an universal crust of exudation, and much of it was collected on the upper surface, and not owing to the position of the viscus." In two cases that died at the London Foundling Hospital, in addition to the usual inflammatory appearances of the lungs, the mucous membranes of the stomach were in each case singularly red and injected. Both stomachs, also, were filled with glairy matter vomited up in the disease. We occasionally, on opening patients that have died of whooping-cough, find the *bronchial glands* considerably enlarged—a circumstance which can hardly be considered accidental, when Blache states it existed in five cases out of nine that he examined. It is also sometimes found that serous fluid distends the ventricles of the brain. It has been a question whether the cerebral symptoms were the result of the violence of the cough, or were peculiar to the nature of the disease. The patient sometimes has died with formidable convulsions, and yet no alteration of texture has been discoverable. When, however, lesions of structure do exist, the mem-

branes are injected, and serum is found effused into their cavity, and into the lateral ventricles. The substance of the brain has more *puncta cruenta* than usual, and some very limited portions are said to have been found softened.

From some of the appearances now enumerated, pathologists have ascribed the complaint to a morbid condition of the pneumogastric nerve—an explanation supposed by some to be confirmed by the circumstance that that pair of nerves are sometimes found red, with the medullary matter altered in colour, dense in texture, and of cartilaginous firmness (KILIAN, AUTENRIETH). Others believe that a specific poison acts on some part of this nerve (TODD).

The results of nineteen observations made by Dr. Graily Hewitt during a recent epidemic of this disease (1855) in children varying from one month old to four years, showed the chief lesion found after death to be collapse of the lung substance—a condition also known under the various names of *foetal condition*, *carnification*, and *atelectasis*. The experimental test to detect the presence of this morbid collapse is that suggested by MM. Bailly and Legendre, and consists in inflating the lung, the effect of which is to produce uniform distention in a simply collapsed lung; but the force necessary to distend the carnified parts is more considerable, and some portions are not capable of inflation by any force. The air-cells, most distant from the roots of the lungs, were most liable to this change, and the margins of the lungs were chiefly affected; and there is generally emphysematous distension of the air-vesicles adjoining the collapsed portions of these organs.

Other pathologists have ascribed the disease to cerebral irritation (WEBSTER in *Medical Gazette*). But facts tend to show that the cerebral symptoms are effects, rather than the cause of the disease. In short, the formation and development of *whooping-cough* seem to follow as the result of a specific poison of an unknown kind, but which is communicated through the atmosphere, and seems to affect directly the pulmonary mucous membrane like *influenza* and *measles*, and like them the disease sometimes becomes epidemic.

It is observed that catarrhal symptoms exist in the first instance, attended by fever and the secretion of a viscid mucus from the bronchial mucous membrane. The irritation arising

from the combined specific influence of the poison on the pulmonary membrane, and the secretion which follows, is attempted to be got rid of by coughing, and in these expiratory efforts the air is expelled with great violence, and so repeatedly and irresistibly that the lungs are ultimately almost emptied of air. At the conclusion of these expiratory efforts the condition of the lungs resembles that produced by *asphyxia*. A sudden inspiration now necessarily and suddenly follows, the air being drawn through the glottis, by the gasping patient, with a force and velocity which gives rise to a shrill, sonorous sound, not unlike the crowing of a cock, and which has been variously named a *kink*, a *hoop*, or *whoop*; and the disease has accordingly received various names, such as *kink-host*, *hooping-cough*, *whooping-cough*, *chincough*.

The anxious and distressing inspirations are scarcely completed when the convulsive expirations of the cough are again renewed, and again followed by the gasping and crowing inspirations, till a quantity of mucus is brought up from the lungs, or till the contents of the stomach are rejected by vomiting. Such are the phenomena of the fit. After it is over, the patient in ordinary cases appears to be but little affected, and returns immediately to play, or to any other occupation which takes the attention at the time.

When these phenomena are prolonged, secondary effects are produced, whose morbid appearances have been noticed. The immediate consequence of the violent fits of coughing is to interrupt the free transmission of blood through the lungs, and the return of blood from the vessels of the head. This causes not only the swellings, redness, and lividity of the face which attend the fits, but also the discharges of blood from the mucous surfaces of the eyes, nose, and ears. A more extended knowledge of the pathology of this disease may be obtained by a careful study of its *symptoms* and *course*.

Symptoms.—The symptoms of whooping-cough arise out of the fever, the cough, the vomiting, and the different inflammations with which the disease may be accompanied.

The rule that fever precedes the cough, though generally true, has many exceptions; for the paroxysms of cough are often established, and more particularly in summer, without being preceded by any febrile phenomena. The severest attack, indeed,

seldom confines the patient to his bed, so that the fever rarely exceeds in severity that accompanying ordinary catarrh. Whooping-cough varies greatly in intensity, and, therefore, may be divided into—

Pertussis mitior, and into *Pertussis gravior*.

Most authors divide the group of symptoms into three stages. The first stage comprehends the period from the first symptoms of illness until the *whoop* confirms the nature of the cough. This is the period of development. The second stage commences as soon as the nature of the cough is determined, and lasts till the violence of the cough and the danger of the inflammation is past. This is the period of spasmodic paroxysms, characteristic of the disease. The third stage is the convalescence of the patient, until the final and happy termination of the disease, or the occurrence of those events which destroy the sufferer.

First Stage.—The early symptoms of the whooping-cough are noticed more especially in the spring and fall of the year, and are those of a common cold—as hoarseness, sneezing, a watery discharge from the eyes and nose, much oppression of the chest, a short dry cough, and such fever and other derangement as usually attend an ordinary cold. This stage may last from one to eight days; but Willan has estimated it from one to two or three weeks, and Lombard has extended it to six or eight weeks.

Second Stage.—It is not until the fever remits, and is about to pass away, that the cough, which had distressed the patient, is followed by the characteristic whoop. On the occurrence, however, of this symptom, the disease is fully formed, and now consists of a series of fits or paroxysms of severe coughing, which occur at uncertain periods; while, during the interval, the patient often enjoys his usual health, recovers all his gaiety, returns to his play, and relishes his food with a good appetite. A paroxysm, or fit of the whooping-cough, generally comprehends the following phenomena:—

The approach of the fit is often denoted by an unpleasant titillation of the glottis, by a sharp pain in the chest, or by a spasmodic contraction of the diaphragm. As soon as the child is thus warned, he instinctively runs to his nurse, and either grasps her arms, or lays hold of her chair, or her dress, to support himself during the paroxysm, which in a few minutes or seconds

is about to follow. In severe cases the cough is quite convulsive, and so rapid is the action of the diaphragm, that the air is almost instantly expelled from the lungs, and the patient, half suffocated, turns black in the face, and frequently passes his urine. At length the crisis approaches, the diaphragm relaxes, and a violent inspiration follows, accompanied by the characteristic *whoop*. This sound perhaps remits, but after a few seconds returns; and thus convulsive inspirations and expirations continue, till the patient is at length relieved by a copious expectoration, or by vomiting. The matters expectorated from the lungs are frequently thick, viscid, and muciform. When vomited from the stomach, the patient throws up a glairy fluid of much tenacity, semi-transparent, and frequently amounting to the greater part of a pint; and should he have recently eaten, the food often returns with it. It frequently happens, however, that the stomach retains the food, and rejects the offending matter. If the fit be violent, the fluid rushes not only from the mouth, but also from the nostrils; and in some instances is mixed with blood, for blood occasionally bursts forth in considerable quantities from the congested vessels of the mouth, the nostrils, the ears, the eyes, and in some instances from the rectum.

If the stethoscope be applied to the chest previous to the fit, we sometimes detect the mucous rhonchus, common to catarrh; yet in most cases the respiration is natural. During the act of coughing the respiration appears completely suspended, and is not sensible to the ear in any part of the chest. On the *whoop*, however, taking place, the air is heard to rush with remarkable violence into the trachea; but at this point it stops for one or more seconds till the bronchial tubes relax, and the air is then admitted into the lungs.

The fit having subsided, the eyes, which seemed to have started from their orbits, resume their natural position, but are inundated with tears, or the conjunctiva is more or less gorged with blood; the natural expression and appearance of the countenance returns, and in a few minutes, in favourable cases, the good spirits of the little patient are renewed, and he eats with appetite. On the contrary, in severe or unfavourable cases, long continued exhaustion, headache, and some fever, are the preludes to convulsions, inflammation, or the other more severe forms of the disease.

The paroxysm varies greatly in frequency and severity; but,

in general, its frequency is as its severity. In ordinary cases it returns every two hours, but in severer cases, and especially during the second and third week, it returns every half or every quarter of an hour, or even oftener. This disease commonly reaches its acmé at the end of the third, fourth, or fifth week; after which the paroxysms diminish in frequency, the intervals are prolonged, and the patient is to a certain degree convalescent. The duration of this second stage is from two to six or eight weeks.

Third Stage.—The third stage commences with the convalescence of the patient, when the paroxysms become milder, the intervals longer, the expectoration more natural and less in quantity, and the vomiting ceases, so that the general health of the patient is much improved. The duration of this stage, however, is often long and variable, and the cough may still harass the patient for many weeks, or even many months. It is to this stage that the term chronic is usually applied.

The whole duration of the stages of whooping-cough are liable to greater variations than in almost any other disease; for the complaint may terminate in two or three days, and after a very few paroxysms, or it may last two, three, or four months, or even for more than a year.

Such is the progress of an ordinary case of *pertussis mitior*; but in particular seasons, and in particular persons, many accidents may arise to complicate the symptoms, and to increase the danger, as inflammation of some of the tissues of the lungs, of the mucous membrane of the stomach or intestines, or of the serous membranes of the brain.

Inflammation of the mucous membrane of the bronchia is the most usual complication of this disease. The form of inflammation may be that in which the secretions are in defect, so that the mucus is not only greatly diminished in quantity, but is thick and viscid, teasing the patient with fruitless efforts to free it from the lung, and thus causing a frequent recurrence of the paroxysm. In other cases it may assume the form of purulent inflammation, the pus secreted being formed into sputa, and moderate in quantity; or it may be thrown up pure, as from an abscess, and so enormous in quantity as to amount to one or two pints in the twenty-four hours. The inflammation of the bronchial membrane may spread to the substance of the

lungs, when the danger, as well as the symptoms of some of the various forms of pneumonia will be added to the disease; but the most formidable accident is when the pleura is inflamed, for then the patient's sufferings during the paroxysm are fearfully increased, from the agonizing pain inflicted during the paroxysm of the cough.

The mucous membrane of the stomach and intestines is often the seat of inflammation; and this is denoted by pain in the epigastrium, and by the suppression of the glairy fluid thrown up by vomiting, so that on the termination of the fit the patient often lies in a state of complete exhaustion, unable to discharge anything either from the stomach or lungs, or even to *whoop*, and he is now said, by the people, to labour under the *dumb kink*.

In mild cases the bowels are little affected in this disease, except that the patient sometimes passes his fæces during the paroxysm. In severe forms the stools are often either black and offensive, or they consist of a colourless mucus, the latter evidently depending on an inflamed state of the mucous follicles.

Headache is a symptom which usually attends the catarrhal stage, but generally ceases when the fever subsides. In some instances it continues throughout the disease, and is not unfrequently the forerunner of fatal convulsions, or epilepsy, or of inflammation of the membranes of the brain, terminating in delirium, coma, hydrocephalus and death.

Diagnosis.—It is impossible to determine whether the febricula of the first stage is the result of simple catarrh, or will, on its subsiding, prove to be whooping-cough. As soon, however, as the cough has been followed for two or three paroxysms by the *whoop*, the diagnosis is perfect, no other disease being accompanied by this symptom.

Cause and Modes of Propagation.—That whooping-cough is induced by a specific poison there is little doubt; but in what manner this agent is generated is not determined. This disease is always sporadic, sometimes epidemic, and the "epidemic influence" is the most common cause and mode of propagation.

The predisposition to this disease is so strong that few persons pass the period of childhood without suffering from it; but it may occur at any subsequent age. The early age at which the large majority of patients pass through the disease is, however, a

sufficient reason for our very slight acquaintance with the predisposing causes.

When the whooping-cough is once excited, the patient evolves a poison which is both infectious and contagious; and the general public are so unanimously of opinion that this disease is infectious, that no parent will permit his yet unaffected child to mingle with such as may be labouring under it. The profession are, with a few exceptions, of a similar opinion. It is supposed to have been first introduced into Tasmania by a female prisoner, and subsequently to have spread both amongst settlers and natives.

The infecting *distance* of the poison must be considerable, from the utter impossibility of isolating the patient at home, or of preventing the spread of the disease in schools.

The fact of the contagious nature of this affection cannot be strictly demonstrated. Its communication, however, by *fomites* gives some ground for the belief that it is so; and it is probably most contagious at the period of its highest development.

Rosen conceives that, without being aware of it, he has often carried the disease from house to house. Frank also says that it is often propagated from patient to patient, from house to house, and from village to village. Lombard states that in Geneva he has often traced the first cases occurring in that city to a neighbouring town, or to a sick child from the country. Whooping-cough was some years ago introduced into St. Helena, where it proved very fatal, the captain of a ship having some children labouring under the disease on board, allowed their dirty linen to be sent on shore to be washed, and so introduced the disease among the inhabitants.

Whooping-cough, as a general principle, affects the same person but once, and the exceptions to this rule are exceedingly few. Blache, however, gives a remarkable instance of a grandfather and grandmother catching it a second time from their grandchild, and all of them labouring under the disease together.

The poison of this disease may co-exist with many other poisons, and in this case they often greatly influence each other's actions. The *small-pox* and *whooping-cough* have often co-existed; and a very common and fatal combination is *measles* and *whooping-cough*. *Whooping-cough* and *cow-pox* are not

unfrequently combined. Indeed, the lower classes look upon vaccination as in many instances a cure for the *whooping-cough*.

If it is established that *whooping-cough* is both contagious and infectious, it follows that the poison must be absorbed both by the mucous membranes and by the cutaneous tissue.

Period of Latency.—Our knowledge of this fact is at present extremely imperfect, but the more generally received opinion is, that the period of latency is about five or six days.

Prognosis.—The proportionate number of deaths to recoveries, in *whooping-cough*, is not determined, but greatly varies in different years; for in one year hardly a death will occur from the disease in a large city, while in another year many children will die. In general, however, the milder forms of the disease are rarely fatal, while the more severe and protracted cases very commonly are so. Lombard thinks station in society greatly affects the mortality; for he says that of ten fatal cases nine belong to the poorer classes. The reports of the Registrar-General show that the mortality is greater from this disease in towns than in the country, being in the metropolis, in 1838, '111 per cent., while in England and Wales it was '061. In the year 1839, also, it was for the metropolis '061 per cent., while for England and Wales it was '053. Lombard gives the ages of forty fatal cases as follows :—

AGES.	CASES.	AGES.	CASES.
From birth to 6 months,.....	6	From 4 to 5 years,.....	2
„ 6 to 12 months,.....	7	„ 5 to 6 years,.....	2
„ 1 to 2 years,.....	10	„ above 6 years,.....	0
„ 2 to 3 years,.....	6		—
„ 3 to 4 years,.....	7	Total,.....	40

Danger from bronchial inflammation is to be dreaded rather towards the end than the beginning of the disease. Convulsions are apt to occur if dentition is going on at the time; and if they arise from the congestion or effusion within the cranium, they are generally fatal.

If a predisposition to tubercle exists, *whooping-cough* may determine the development of *phthisis*.

Treatment.—The stage of invasion is seldom marked by symptoms of greater severity than those of common catarrh, and consequently, except putting the patient on a low or very

moderate diet, and attending to his bowels, there is little occasion for medicine.

The *whoop* having confirmed the nature of the affection, and the second stage being established, the disease will run its course, and one of two indications of treatment may be followed. The first is to prevent, if possible, convulsions, or any attack of inflammation, either of the lungs, the stomach, or of the membranes of the brain. The second indication, after the period of danger is past, is to prescribe such medicines as may interrupt the course and anticipate the time of the spontaneous cessation of the disease.

The best mode of obviating the danger of cerebral irritation, or of inflammation of any of the organs that have been mentioned, is to mitigate and control, as far as possible, the frequency of the paroxysms, to check those secretions which are in excess, and to excite those which are in defect, and these objects are best obtained by mild sedatives, combined with gentle purgatives or laxatives.

The choice of the sedative has been considered a matter of much importance. The continental physicians have bestowed much praise on *belladonna*, others on *hemlock*, others on *henbane*, while some have contented themselves with *opium*. It must be admitted, however, that none of these narcotics possess any specific property in controlling this disease, so that the selection of the particular one must be left to the discretion of the practitioner. But supposing the patient to be a child, as the head is especially the organ to be protected, the mildest sedatives, such as *hyoscyamus*, or the *syrup of poppies*, are the safest and best. Should, however, *belladonna* be selected, if the child be under *four* years of age, the dose ought not to exceed *one-eighth of a grain*; or if *hyoscyamus*, *half a grain to a grain*, every six or eight hours; while if it be the *syrup of poppies*, this medicine should be given in such *fractional* doses of a *drachm* as are suited to the age. *Powdered belladonna root* has been recently recommended by Vollaut. The dose is *one-fifth* of a grain, given at first *once*, then *twice*, then *four times a-day*, and so on until the paroxysms begin to subside, when it is to be given at much longer intervals. Thus he says the spasmodic period may be positively arrested in three or four days. The powder of the leaves he considers to have little efficacy. (*Syden. Soc. Year-*

Book, 1862.) Infusion of wild thyme, slightly sweetened and mixed with gum, is also said to effect great improvement in cases of spasmodic cough (JOSET, l. c.).

But an opiate, in the early stage of the disease, ought not to be administered alone, and some purgative or laxative ought, as a general rule, in all cases, to be combined with it. The selection of the particular medicine is perhaps unimportant, and any vegetable or saline purgative will perhaps answer equally well, as the *confectio sennæ*, *rhubarb*, *castor oil*, or *manna*. The neutral salts, however, sit easiest on the stomach, and (as the medicine must be continued) are the most agreeable to the patient. *Opium* is the most efficient remedy in allaying the cough, but is liable to the objection of being apt to check the mucous secretion.

Towards the close of the second stage the symptoms may, in a few instances, become unfavourable, and cerebral irritation, with convulsions, or inflammation of the membranes of the brain, of its substance, or of the tissues of the lung, or of the alimentary canal, may complicate the disease, and now the treatment of the case is always exceedingly difficult, and frequently unsuccessful.

If the convulsions should come on suddenly, and without headache, or other symptom of inflammatory action, small doses of any opiate, and *mustard poultices* to the feet, often relieve the patient; but should the convulsions still continue, an *asafoetida injection* may be administered. It often happens that the convulsions are combined with a suppression of the vomiting, and of the usual glairy discharge; and in these cases *leeches*, followed by a large *lintseed poultice*, should be applied to the epigastrium. If the disease should proceed, and headache or other symptom show an affection of the membranes of the brain, *leeches* should be applied to the temples and *cold* to the head.

When the poison excites inflammation of the tissues or substance of the lungs, *bleeding* to a limited amount may be required; but we should be satisfied with such mitigation of the symptoms as may obviate immediate danger, and even that is not always obtained, since the affection is not to be subdued by bleeding, as in simple inflammation; for, being dependent on the action of a morbid poison, it will run a given course. Blache bled in nine cases, either with the lancet, by leeches, or by cupping, and in one case no less than five times; yet, he adds, with a desolating want of success, and eight out of the nine cases

terminated fatally. This result makes him add an axiom, in which every practitioner will agree, that there is in severe *whooping-cough*, as in *typhus*, *cholera*, and many other affections, an unknown element which modifies and gives a specific character to all these intercurrent inflammations.

If the intestinal canal be affected, some purgative, combined perhaps with *calomel*, may be necessary to act on the bowels and free them from their contents; and if the stools be white and muciform, and the patient not relieved, an enlarged state of the follicles may be suspected, and consequently a *lintseed poultice* should cover the abdomen for some hours, preceded, perhaps, by an *enema of syrup of poppies* and *barley water*, and which should be administered night and morning. Many other modes of treatment have been recommended for the cure of whooping-cough, and more especially a treatment by *emetics* repeated every second day. *Ipecacuanha* is the best emetic, and may be given every second day as such, with smaller doses in the interval every two or three hours, so as to sustain a slight degree of nausea.

The disease having passed into the third stage, and the inflammation or other threatening symptom, if any has existed, having subsided, it is desirable to attempt to abridge the duration of the cough, which often extends to a most distressing length; and for this purpose *tonics*, *antispasmodics*, *counter-irritants*, and other remedies, either externally or internally, have been recommended.

The more stimulant antispasmodics, as *asafoetida*, *musk*, *castor*, *oil of amber*, *cantharides*, and *camphor*, are the remedies which have obtained the most suffrages in the cure of this stage of the whooping-cough. But the two first are most esteemed, and some persons even consider *asafoetida* to be a specific, not only in this, but in every other stage of the disease. It should be given in emulsion in the dose of one or two grains to a child two years old, repeated three or four times a-day, or even as often as every two or three hours. Cullen, however, preferred *cinchona* to *asafoetida*, and considered it "the most certain means of curing the disease." Many other remedies have been mentioned, as *alum*, *hydrocyanic acid*, *oxide of zinc*, *arsenic*, and many preparations of *iron*, and all of these remedies have perhaps been found to a certain extent useful; but, in estimating the results of remedies, we should be careful not to mistake temporary recovery for cure; and the fact

of so very many remedies being highly spoken of might create a doubt as to the value of either.

When internal remedies have failed to make any impression on the whooping-cough, the cure is often attempted by means of local treatment, or by derivatives. The early physicians applied *actual cautery* to the nape of the neck; the modern ones, *blisters* to the spine, or directed the back to be rubbed with the *unguentum antimonii cum potassio tartarizati*, or with some liniment or embrocation, as the liniment of *camphor* or of *ammonia*, or with *usafœtida*, *oil of amber*, *oil of turpentine*, or the *tincture of cantharides*. The general opinion, however, is, that these do little good unless they contain some opiate, whose absorption they facilitate. Foot baths and the warm bath have also been used, and often with much efficacy.

When ordinary remedies have failed, a change of air is a resource of great value, and was first mentioned by Dr. Forbes, in his thesis *De Tussi Convulsivi*, in 1754; and since that period it has been recommended in dangerous cases by most physicians, with that praise it so eminently deserves. While it is determined that a change from the bad air of a town to the purer air of the country is at all times of great benefit, Lombard contends that he has found a change from the country to the town to be not less beneficial, and that the patient is benefited even by the removal to so short a distance as half a mile. Indeed, it is impossible to witness more striking instances of the advantages of treatment than we occasionally observe in patients when removed from large towns to their environs, for even in a few hours they often recover from an apparently hopeless state. A sail across a river is also beneficial, although the distance may be short.

Dietetic and General Treatment.—The patient should not be allowed animal food from the commencement almost to the termination of the disease in its acute form. It is desirable also that the temperature of his apartment should be regulated, and that he should not be exposed to any considerable or sudden change from heat to cold. In mild weather also, if no local symptom forbids, he should be permitted to take exercise in the open air. He should likewise be recommended to wear flannel.

There are no known means of prevention, except an entire removal from every source of contagion.

DIPHTHERIA—*Diphtheria*.

Definition.—*An acute specific disease, which runs a quick and definite course in eight to fourteen days. Its anatomical character is, spreading inflammation of the mucous membrane of the pharynx, attended by exudation of lymph. The disease is attended with great prostration of the vital powers; and, in fatal cases, by albuminuria; and, in cases which recover, a remarkable series of nervous phenomena supervene, characterized by paralysis and sometimes by fatal syncope.*

Historical Notice.—Diphtheria is by no means new to England; and the writings of the older physicians prove that from time to time it has been epidemic, or at least very common in many parts of England. The historical accounts of the disease also show that it has preserved its essential character and nature from age to age. Ever since the end of the "sixteenth century, diphtheria has been observed in every region of the Old and New World. At first it continued for a time in Spain; and during nearly forty years was noticed in different parts of the peninsula. Rather later all Italy was successively afflicted by it. Towards the middle of the last century especially, epidemics of the disease have occurred, less general and less prolonged, but more multiplied in England, in France, in Sweden, and in America, and particularly at New York and Philadelphia. It terminated the life of the celebrated Washington, and of the Empress Josephine. The outbreaks have usually been limited in extent, sometimes not spreading beyond a single dwelling, building, village, or quarter of a large town. It prevailed as an epidemic in the north of France and south of England in 1859, to a considerable extent; and since that time many excellent monographs have been written on the subject in our own country, among which those of Hunter Semple, Chatto, Wade, Ernest Hart, Greenhow, Sanderson, and Jenner, are conspicuous.

Pathology and Morbid Anatomy.—In this disease, as in many others of the *miasmatic* kind, the *general* or the *local* symptoms may predominate, and give a special feature to the case; and the patient may die from the severity of the general disease, or from the severity of some one of the local lesions.

The mucous membrane covering a tonsil may be the primary

seat of the characteristic local exudation, or the arches of the palate, or the posterior surface of the soft palate, the uvula, the nares, or the pharynx may be the primary seat. At first there is redness and swelling; and the normal mucous secretion is so altered in its physical properties that it adheres by its own increased viscosity to the mucous membrane. A white or grey patch now forms on the membrane, which indicates the presence of a layer of lymph on the reddened surface.

The layer of lymph may thus spread from one or from several centres over the reddened surface; and this redness may involve the whole mucous membrane within reach of the eye. The lymph which grows upon this reddened surface may descend into the larynx, the trachea, and the bronchi; and Dr. Jenner has known it to extend into the œsophagus and stomach. (*Diphtheria: its Symptoms and Treatment*, by Dr. Jenner, p. 4.) If the lymph be torn from the mucous membrane, a raw, bleeding surface is exposed, which in a few hours is again covered by a new layer of lymph. The lymph of diphtheria has a variety of appearances. Sometimes it is granular, with very little consistence or tenacity. Sometimes the part is covered with a pulpy substance of a white or grey colour; but this pellicle is constant in some form or other, and is possessed of the power of reproducing itself. It is this specific exudation which establishes the disease as one *sui generis*, and to which Bretonneau gave the name of "*Diphtheritis*," and which has been subsequently modified to "*Diphtheria*." The latter term has the advantage of being the shorter word, and is that adopted by the Registrar-General. Etymologically, the terms are derived from $\delta\iota\phi\theta\epsilon\rho\alpha$ *vel* $\delta\iota\phi\theta\epsilon\rho\iota\varsigma$, signifying the prepared skin of an animal; while $\delta\iota\phi\theta\epsilon\rho\iota\tau\eta\varsigma$ *vel* $\delta\iota\phi\theta\epsilon\rho\iota\alpha\varsigma$ signifies that which is covered with a fur or with a leathern coat.

In microscopical characters it does not appear that this "fur," "pellicle," or "false membrane" of diphtheria can be distinguished from the concrete exudation on blistered surfaces, or that which forms in the angina of scarlatina (EMPIS). The commencement of the formation of the pellicle is in reality an act of coagulation. The mucous membrane exudes, in the first instance, a fluid in which the fibrine coagulates; and such coagulated fibrine forms the tube casts which line the surface of the larynx and trachea, but from the mucous surface of which they come to be separated

by a considerable interval; and generally it may be stated that there is the greatest possible variation as to the extent, the consistence, the colour, and adherence of the pellicle. Sometimes the particles of lymph are so thin, soft, and separated from each other, that the term membrane can scarcely be correctly applied to it. At other times it is tough, elastic, and as much as an eighth of an inch in thickness. In the one case the lymph resembles cream in consistence; in the other it resembles wash-leather; and between the two extremes we meet with all intermediate conditions as regards consistence and tenacity. Pus, granular corpuscles, oleo-protein granules, and epithelium constitute the bulk of the softer forms of the so-called lymph; while such fibres as we see in the buffy coat of blood coagula constitute the bulk of the toughest variety of the lymphic pellicle (JENNER). The presence of vegetable growths, as the *oidium* of *muguet* (VOGEL), occurs in the pellicle of diphtheria from time to time; and has been reported by some as a constant occurrence. It is, however, by no means so; and its accidental existence is no evidence that epiphytes have any essential connection with cases of diphtheria (JENNER).

The lymphatic glands to which the lymphatics of the pharynx lead are found in cases of diphtheria to be larger, redder, and moister than natural; and if the disease has continued long, they become brittle, pale, and of a brightish red colour on section—characteristic of inflammation of their substance. These enlarged glands may be felt during life behind the angle of the lower jaw on either side, as well as down the neck by the sides of the larynx, when that organ is implicated. Such enlargement of the glands is just in proportion to the severity and depth of the local, nasal, pharyngeal, laryngeal, and tracheal disease; and when the discharges from the pharynx are fetid, and the mucous membrane sloughy, not only are the glands behind the angles of the jaw enlarged, but the connective tissue in which they are placed is the seat of the effusion of serum and even the exudation of lymph, so that very great general swelling of the parts is the result.

Condition of the Urine in Diphtheria.—Albumen is found in many cases; 50 per cent. (LEE), 66 per cent. (BONCHUT, EMPIS), in the majority (MANGIN), in all the cases examined by the observer (SANDERSON). Its quantity appears to be sometimes

enormous, so that the urine becomes quite solid from heat and nitric acid (PARKES, l. c.).

Although it is not established that albuminuria is an essential element in the disease, yet it is a most important symptom both as connected with the pathology of the disease and with its prognosis. The first discovery of the relation of albuminuria to diphtheria was made by Mr. Wade, of Birmingham, and was communicated to the Queen's College Medico-Chirurgical Society in December, 1857. During the following year Bonchut and Empis made a similar discovery in Paris. These observers attach very great importance to the renal complication, as affording an anatomical explanation of the fact that, in many cases of diphtheria in which death occurs neither by suffocation nor by septic poisoning, it cannot be due to local lesion. Bonchut considers it a sign of the commencement of purulent infection in diphtheria, and coincides with very great gravity of the disease. The blood then assumes the tinge of bistre; and numerous masses of pulmonary apoplexy may be found after death, resembling those which precede the development of metastatic abscesses in the lungs. Mr. Wade is of opinion that albuminuria produces a diminution in the total amount of solid excreta;—the special function of the kidney being suspended, symptoms arise which indicate the retention within the body of those matters which should be excreted.

Dr. Sanderson is of opinion that neither of these doctrines regarding the pathology of albuminuria in diphtheria is the true one. In several of the cases related by him the cessation of albuminuria was coincident with amelioration of the patient's condition and the disappearance of the most alarming symptoms. The early period of the disease at which the albumen appears, and the short time during which it lasts, are facts of great importance. Dr. Sanderson is of opinion that either (1.) the kidneys must be the seat of the primary morbid process; or, (2.) the albuminuria must depend on an original change in the blood. That it is not due to the former of those is evident from the fact that the renal disease is only coincident with disease elsewhere (*e. g.*, in the fauces), so that the special morbid condition of the blood induced by the *diphtheria miasm* must be regarded not only as the primary cause of albuminuria, but of all the other symptoms.

This Dr. Sanderson illustrates by comparing the poison of diphtheria to that of the poison of cantharides, which, from the moment it enters the circulation, manifests its presence by albuminuria, and produces a series of anatomical changes in the kidney, which are identical with those described by Mr. Simon and Dr. Bristowe in diphtheria.

Dr. Sanderson's observations still further show that, at the acmé of the disease, when the urine was intensely albuminous—when there was complete anorexia, and the ingesta reduced to a minimum—that then the quantity of urea excreted in twenty-four hours was about twice as great as that excreted during a similar period when convalescence was established—when the patient was eating, with an appetite, the ordinary hospital diet, with extras.

Thus it is shown, as Dr. Sanderson observes, that diphtheria agrees with the other pyrexia in being attended with a marked increase in the excretion of urea, and that the existence in the kidney of the condition implied by albumen and fibrinous casts in the urine does not necessarily interfere with increase in the elimination of nitrogenous material. There is, therefore, no reason to apprehend the occurrence of uræmia as a consequence of the renal complication in diphtheria, this complication not being the cause of the blood-poisoning, but merely the index of its existence. (*Brit. and For. Med.-Chir. Review*, Jan., 1860, p. 196.)

Phenomena and Symptoms.—The *prodromata* which forebode an attack of diphtheria may be set down as general *malaise*, anorexia, slight fever, dysphagia, and glandular swelling. The symptoms generally supervene very gradually and insidiously; but feelings of depression, prostration, and muscular debility prevail, attended by headache, nausea, diarrhoea, and chilliness. There is a sense of stiffness about the neck and throat, and the drowsiness which often attends the accession of an attack of diphtheria may lead the patient to fancy he has caught a slight cold in the throat while indulging in a short sleep.

Dr. Jenner has grouped his cases of diphtheria into *six* varieties, as follows:—(1.) *The mild form of diphtheria*; (2.) *The inflammatory form*; (3.) *The insidious form*; (4.) *The nasal form*; (5.) *The primary laryngeal form*; (6.) *The asthenic form*.

In the *mild form of diphtheria* the general symptoms and the

local lesions are trifling, and no sequelæ follow. Febrile disturbance prevails to a slight degree; and there may be the least possible soreness of the throat on swallowing. No albumen occurs in the urine, and no nervous symptoms follow. Dr. Jenner is of opinion that many inflamed throats, when *diphtheria* is epidemic, have their origin in the *diphtheria miasm* (whatever that may be), just as many cases of *diarrhœa*, when *cholera* is epidemic, originate in the *cholera miasm*; and it is as difficult to say in some cases that an inflamed pharynx is not due to mild diphtheria as it is to say that a serious diarrhœa is not cholera.

In the *inflammatory form of diphtheria* symptoms of severe *cynanche pharyngea* precede the exudation of lymph. There is redness, of a vivid or dusky hue, and swelling of the mucous membrane, covering the arches of the palate, the uvula, and the tonsils. The swelling is often considerable, from the effusion of serum into the submucous tissue, which becomes of a jelly-like transparency and aspect. The pain in the act of swallowing is great, so that deglutition becomes impossible. The febrile disturbance may be extreme or moderate; and although the pulse is frequent, it soon becomes weak, and there is the sense of considerable prostration. In from twelve to forty-eight hours after the first symptoms of the throat affection supervene, a layer, more or less extensive, of tough lymph coats the inflamed surface, and death may follow from extension of the exudative process into the larynx or trachea. The urine may contain albumen, and sometimes the joints are swollen, hot, and tender.

The *insidious forms of diphtheria* are dangerous, because they seem sudden and unexpected. The general symptoms are not severe. There is no marked soreness of the throat, no notable swelling of the lymphatic glands; but suddenly laryngeal symptoms supervene, and death rapidly follows from suffocation; and the disease may be confounded with primary croup, if the pharynx has not been examined.

In the *nasal form of diphtheria* a sanious discharge from the nose attracts attention, after some febrile disturbance of a low type. The glands about the angle of the jaw begin to swell, the arches of the palate and tonsils become red and swollen, mucopurulent fluid bubbles in quantity from the narrowing isthmus of the fauces, and is apt to prevent the physician from seeing

clearly the state of the pharyngeal mucous membrane. After a few days the disease may subside so completely as to leave its nature doubtful; but it may, on the other hand, spread to the larynx or the pharynx, when laryngeal or pharyngeal symptoms prevail, and the diagnosis is easy.

In *primary laryngeal diphtheria* the disease begins with painful deglutition, and is attended by redness and swelling of the mucous membrane of the pharynx, arches of the palate, uvula and soft palate. Laryngeal symptoms rapidly supervene; and lymph may be seen on the arches of the palate, the exudation being more abundant at the base of the arch than above it, looking as if it spread from the larynx. Death threatens from *apnoea*.

In *the asthenic form of diphtheria* the patient dies from the constitutional effects of the general disease, which may begin with general and local symptoms of very moderate severity. The pulse, however, soon becomes rapid and feeble; the sense of weakness and of illness becomes extreme; the skin has a feverish pungency of heat to the touch; the complexion assumes a dirty-looking, pallid, and opaque aspect; and from an early period of the disease the tongue is brown, with *sordes* on the teeth. More or less lymph may be seen on the pharyngeal mucous membrane; and this lymph is of a granular, pulpy, or soft form, according to the experience of Dr. Jenner. The patient may also swallow with perfect facility, and the throat symptoms may appear to be trivial in degree, even when the pharyngeal mucous membrane is covered with lymph. In some cases, however, the pain on swallowing is extreme. The exudative process may extend to the larynx, and this extension is indicated by a little huskiness and want of power in the voice, and imperfect laryngeal breathing. Death tends to supervene by asthenia about the tenth or twelfth day of the disease, preceded or not by delirium, which may commence at an early period of the disease.

There is no sharp line of distinction, however, between these several varieties of diphtheria.

The duration of cases of diphtheria varies from forty-eight hours to fourteen days; and when the disease is fatal within a week, it is so by extension of the exudative process to the larynx; and laryngeal symptoms rarely commence after the

expiration of the first week of the disease. In more than half the fatal cases of diphtheria death results directly from disease of the larynx. When death occurs from asthenia the fatal result usually takes place about the second week of the disease. In the cases that are not fatal the specific disease terminates between the eighth and fourteenth day of the illness (JENNER).

Prognosis.—However mild a case of diphtheria may appear to be, no case is unattended with danger. The great danger during the first week is from extension of the exudative process to the larynx; and the least laryngeal quality in the respiration heard at the bed-side is suggestive of danger. Subsequently to the first week death is to be apprehended from exhaustion and loss of nervous energy. An extremely rapid and feeble pulse is of grave import; and a very infrequent pulse is of fatal significance. Vomiting is another unfavourable symptom, especially if it should recur many days in succession. Hæmorrhages and albumen in the urine indicate blood change of great severity; and if the albumen is abundant, a fatal termination of the case may be expected. All the cases in which Dr. Jenner has known delirium to occur have ended fatally.

The danger in diphtheria seems to be in proportion to the youth of the patient. In the child death is generally due to extension of the disease to the larynx;—after puberty it more often occurs from the general affection.

Sequelæ.—After the termination of the disease, symptoms of a very peculiar and characteristic kind are apt to supervene. The phenomena are referable to deranged innervation. The impairment of function is betrayed by the condition of the voice, and by the act of swallowing; and there appears to be loss of sensibility of the *velum pendulum palati* (Trousseau). The most alarming symptoms, however, are referable to the heart. The frequency of its beats per minute begin to diminish, and a sense of languor supervenes, with tendency to vomiting. The heart's beats are found to be feeble, infrequent, and slow, and death supervenes from cessation of the heart's action (JENNER); or suddenly from the deposition of fibrine within the heart, or in one of the great vessels (TANNER).

In other cases the paralysis is more widely spread, and the nervous symptoms more striking. In such cases convalescence does not progress after the fever, but the patient loses power,

growing less and less able to sustain existence. The power over the movements of the limbs becomes impaired, and death takes place often in a fainting state.

These phenomena of impaired nervous power generally betray themselves within three weeks from the date of convalescence; and the longest period at which Dr. Jenner has known death to occur after the first symptoms of diphtheria has been about two months.

Propagation of Diphtheria.—The disease seems to be infectious; and family constitution (rather than any anti-hygienic conditions) favours its development and determines its progress (JENNER, GREENHOW, SANDERSON).

Treatment.—So long as there is heat of skin and firmness of pulse the physician ought to abstain from alcoholic stimulants, and rest contented by giving such saline medicines as exert a slight action on the skin and on the kidneys, or on both. *Acetate of ammonia* and *citrate of potash* are well suited for this purpose. The bowels should be opened freely by a dose of *calomel* and *jalap*; or, by *calomel* and *colocynth* pill, followed in the inflammatory or *sthenic* forms of the disease by a saline aperient—*e. g.*, *sulphate of magnesia* in the *infusion of roses*.

The throat affection should be treated with warm fomentations externally, and by the inhalation of water vapour with acetic acid. A wine-glassful of vinegar to a pint of water is a good proportion (JENNER), and an inhaler should be used, as mentioned at page 334, under scarlet fever. Dr. Jenner recommends Squire's inhaler as the best. A lead gargle is also of service, composed of one drachm of the solution of diacetate of lead in eight ounces of rose water; but gargles must not be persisted in if pain is caused by their use. The temperature of the room in which the patient is confined to bed ought to be kept at 68° Fahr., and its atmosphere made moist by the steam from a kettle with a long spout constantly boiling on the fire. If the patient can be enveloped in a warm moist atmosphere, so much the better; and this may be done by making a tent with blankets over the bed, and, by the aid of a spirit lamp, a tin kettle of boiling water may be maintained at the boiling point, and its steam thus made to envelop the patient.

If feebleness of pulse supervene, if the redness of the throat assume a dusky hue, if the sense of general weakness becomes

extreme, wine in large doses frequently repeated is required. Six or eight ounces of port or sherry during the day for an adult may be given from the first, with as good a diet as the stomach can digest. During the course of the disease, much larger quantities of wine and even brandy may be necessary; but the quantity of stimulants must be regulated by the habits and age of the patients. A child of three years of age may take with advantage one or two drachms of brandy every hour—*i. e.*, from three to five ounces of brandy during the twenty-four hours (JENNER). Under all circumstances efficient daily action of the bowels must be secured, and the urinary and intestinal secretions should be examined daily.

If blood or albumen appear in the urine, diuretics are contra-indicated. Mustard poultices, warm lintseed-meal poultices, or the warm wet sheet as recommended by Dr. Huss in typhoid fever, and referred to at page 420, may be applied to the loins under these circumstances. Tincture of the sesquichloride of iron has been recommended by Dr. Hislop, of Birmingham; and it may be advantageously combined with quinine in the following formula (TANNER):—

R. Quinæ disulphatis, gr. ii.; Acidi Hydrochlorici diluti, m. x.; Tincturæ Ferri sesquichloridi, m. xv.; Infusi Calumbæ, ʒi.; *misc.*; *fiat haustus, omnibus sextis horis sumendus.*

With regard to topical applications, Dr. Jenner is of opinion that repeated applications to the throat of caustic solutions are injurious. He recommends one single but efficient application of a strong solution of nitrate of silver (ʒi. to ʒi. of water), as a remedy which may stay the *spread* of the exudative inflammation; but that, on the whole, *hydrochloric acid* and water in equal parts will more frequently attain the object. It is especially the surface *round* the exudation, as well as the exudation itself, that should be painted well over with the solution, the brush being passed over the surface two or three times in quick succession. The white discoloration which results must not be confounded with the spread of the diphtheritic exudation. The discoloration from the acid passes away in about thirty-six hours; and that from the nitrate of silver somewhat quicker.

. There is considerable differences of opinion regarding the usefulness of topical applications, and the best means of applying

them. The tincture of the sesquichloride of iron is recommended by some to be gently painted over the fauces; and Dr. Greenhow remonstrates against the application of the more severe topical remedies. The pellicle or false membrane ought never to be torn off.

Tracheotomy undoubtedly saves a small proportion of cases. It ought to be had recourse to if the exudative inflammation extends to the larynx and advances in severity. The degree and increase of the recession of the soft parts of the parietes of the chest during inspiration is the guide to its necessity. In the adult laryngotomy is to be preferred to tracheotomy. Dr. Jenner is of opinion that the opening should be made even through the seat of disease, and not below it; for, in opening through a healthy part, a new centre of irritation and inflammation is established. The sole object contemplated by an opening in the windpipe is the prevention of death by suffocation. By so averting death, time is gained for the general disease to run its course (JENNER).

CROUP—*Cynanche Trachealis*.

Definition.—*A specific disease, accompanied by the exudation of an albuminous material upon the mucous membrane of the epiglottis, glottis, larynx, or trachea, and sometimes over all of these parts, indicated by accelerated, difficult, wheezing, or shrill respiration; short, dry, constant, barking cough; voice altered by hoarseness, with spasm of the interior laryngeal muscles, and pain and constriction above the sternum; frequently followed towards the close of the disease by expectoration of a membranous albuminous substance, or even of a cylindrical cast of some portion of the breathing tube. The disease occurs in children, and may terminate fatally either in suffocation or exhaustion of the vital powers.*

Pathology and History.—It has often excited much surprise that a disease so distinctly marked in its symptoms should not have been accurately described before the middle of the eighteenth century, when Dr. Francis Home published a treatise on the *suffocatio stridula* or *croup*, in 1765, as it was observed in Leith, Musselburgh, and the vicinity of Edinburgh. It has been described under the name of *cynanche trachealis*; and Dr. Farr

has proposed for it the name of "*tracheulia*" in scientific nosological nomenclature.

Before the time of Dr. Home, however, there is reason to believe that the disease was confounded with other affections of the throat and breast resulting simply from exposure to cold. It was certainly also described and distinguished by Martin Shisi, in 1749, at Cremona, and by Starr, of Liskeard, in Cornwall, in the same year. (*Phil. Trans.*, 1750.) Many physicians have described the disease since that time, and none with more minuteness than Dr. Cheyne, of Leith, who observed it for several years, and illustrated its pathology by careful dissections.

The most remarkable pathological phenomena of croup are to be observed in the exudative process which attends the inflammation in the windpipe, and the formation of a false membrane, almost peculiar to children, but sometimes seen in adults. When death takes place after an illness of four or five days, the windpipe is found to be lined with a white or grey substance. The membranes thus formed vary much in thickness and consistency. Some are so thin that the mucous membrane is readily seen through them, while others are many lines in thickness, exceeding even that of the mucous membrane itself, and consequently opaque. With respect to their consistency, some are so little coherent that they are almost diffuent, while others can be detached for a considerable extent without rupturing. The false membrane, though occasionally only partial, yet more commonly embraces the entire circumference of the larynx, forming a complete hollow cylinder, adapted to the walls of the larynx. The membrane is in most instances limited to the larynx, but in some cases it extends down the trachea to the bifurcation, while in a very few cases it reaches even to the minutest branches of the bronchi. M. Hussenot says, of 120 cases he examined in 1778, it did not extend beyond the larynx, while in 42 cases it invaded the trachea or bronchi. The membrane thus formed is, in a few instances, removed by the cough, but more generally it adheres with so great tenacity that Gendrin conceives that it can only be detached by a thinner and more serous secretion taking place from the mucous membrane beneath it, which loosens and displaces it. The extent of the exudation, as indicated by the surface covered, is perhaps the most interesting and practically useful part of the pathology of the disease. The place

first and most particularly affected is the upper part of the *trachea*, about an inch below the *glottis*. In that part patients complain of a dull pain. External swelling has been observed there; and the morbid membrane is found spreading from that place downwards. The back part of the *trachea*, where there are no cartilages, seems to be its first and principal seat (HOME). According to Guersent, false membrane is never entirely absent from the larynx. Sometimes it is confined to the *glottis*, and sometimes lines the whole interior of the larynx, including the ventricles, and not unfrequently it extends throughout the *trachea*, and, for a greater or less distance, into the bronchial tubes. Dr. Wood instances a case in which he saw the false membrane line the upper portion of the bronchia, the whole *trachea* and larynx, and the pharynx as low down as the *oesophagus*. More frequently, he says, the exudation is in the form of patches, or long narrow ribbons, and occasionally, in the earlier stages, it has a granular aspect, with the red mucous membrane appearing in the intervals of the imperfectly connected patches. According to Cheyne, in none of the cases recorded by him was membranous exudation observed in the laryngeal mucous membrane; and if the inflammation extended to this part, it was only slight, and its effects were seen in a little puriform fluid in the membrane of the *circoid* or thyroid cartilages. Some state that it is essential to the constitution of croup that the larynx should be more or less involved in inflammation, or high vascular irritation, accompanied with spasms of the internal muscles of the larynx (WOOD). Others say that the inflammation in croup is truly tracheal and even bronchial (CRAIGIE, COPLAND). In the more acutely inflammatory form it may extend to the larynx and *epiglottis*, in some cases; in others, to the first ramifications of the bronchi, and sometimes in both directions (COPLAND).

Dr. Copland, who has paid particular attention to the pathology of croup, states the following as general inferences from his observations:—“(a.) That the mucous membrane itself is the seat of the inflammation of croup; and that its vessels exude the albuminous or characteristic discharge, which, from its plasticity and the effects of temperature and the continued passage of air over it, becomes concreted into a false membrane;—(b.) That the occasional appearance of blood-vessels in it arises from the

presence of red globules in the fluid when first exuded from the inflamed vessels, as may be ascertained by the administration, upon the approach of the symptoms, of a powerful emetic, which will bring away this fluid before it has concreted into a membrane; these globules generally attracting each other, and appearing like blood-vessels, as the albuminous matter coagulates on the inflamed surface;—(c.) That the membranous substance is detached in the advanced stages of the disease, by the secretion, from the excited mucous follicles, of a more fluid and a less coagulable matter, which is poured out between it and the mucous coat; and, as this secretion of the mucous *cryptæ* becomes more and more copious, the albuminous membrane is the more fully separated, and ultimately excreted if the vital powers of the respiratory organ and of the system be sufficient to accomplish it;—(d.) That sub-acute or slight inflammatory action may be inferred as having existed, in connection with an increased proportion of fibro-albuminous matter in the blood, whenever we find the croupal productions in the air-passages; but that these are not the only morbid conditions constituting the disease;—(e.) That, in conjunction with the foregoing—sometimes only with the former of these in a slight degree—there is always present, chiefly in the developed and advanced stages, much spasmodic action of the muscles of the larynx, and of the transverse fibres of the membranous part of the trachea, which, whilst it tends to loosen the attachment of the false membrane, diminishes, or momentarily shuts, the canal (of the larynx) through which the air presses into the lungs;—(f.) That inflammatory action may exist in the trachea, and the exudation of albuminous matter may be going on for a considerable time before they are suspected,—the accession of the spasmodic symptoms being often the first intimation of the disease; and these, with the effects of the pre-existing inflammation, give rise to the phenomena characterizing the sudden seizure;—(g.) That the modifications of croup may be referred to the varying degree and activity of the inflammatory action, the quantity, the fluidity, or plasticity of the exuded matter, the severity of spasmodic action, and to the predominance of either of these over the others in particular cases, owing to the habit of body, temperament, and treatment of the patient, &c.;—(h.) That the muco-purulent secretion, which often accompanies or follows the detachment and discharge of the concrete or membranous

matters, is the product of the consecutively excited and slightly inflamed state of the mucous follicles, the secretion of which acts so beneficially in detaching the false membrane;—(i.) That a fatal issue is not caused merely by the quantity of the croupal productions accumulated in the larynx and trachea, but by the spasm, and the necessary results of interrupted respiration, and circulation through the lungs;—(k.) That the partial detachment of fragments of membrane, particularly when they become entangled in the larynx, may excite severe, dangerous, or even fatal spasm of this part, according to its intensity relatively to the vital powers of the patient, and that this occurrence is most to be apprehended in the complicated states of the malady where the inflammatory action, with its characteristic exudation, spreads from the fauces and pharynx to the larynx and trachea, the larynx being often chiefly affected in such cases, and from its irritability and conformation giving rise to a more spasmodic and dangerous form of the disease;—(l.) That the danger attending the complications of croup is to be ascribed not only to this circumstance, but also to the depression of vital power, and the characteristic state of fever accompanying most of them, particularly in their advanced stages;—(m.) That irritation from partially detached membranous exudations in the pharynx, or in the vicinity of the larynx or epiglottis, may produce croupal symptoms in weak, exhausted, or nervous children, without the larynx or trachea being themselves materially diseased; and that even the sympathetic irritation of teething may occasion the spasmodic form of croup, without much inflammatory irritation of the air-passages, particularly when the *prima via* is disordered and the membranes about the base of the brain are in an excited state;—(n.) That the predominance in particular cases of some one of the pathological states noticed above (g.), as constituting the disease, and giving rise to the various modifications it presents, from the most inflammatory to the most spasmodic, may be manifested in the same case, at different stages of the malady, particularly in its simple forms, and in the relapses which may subsequently take place; the inflammatory character predominating in the early stages, and either the mucous or the spasmodic, or an association of both, in the subsequent periods;—(o.) That the relapses, which so frequently occur after intervals of various duration, and which sometimes amount to seven or eight, or are

even still more numerous, may each present different states or forms of the disease from the others; the first attack being generally the most inflammatory and severe, and the relapses of a slighter and more spasmodic kind; but in some cases this order is not observed, the second or third, or some subsequent seizure, being more severe than the rest, or even fatal, either from the inflammation and extent of exudation, or from the intensity and persistence of the spasmodic symptoms,—most frequently from this latter circumstance. The above inferences, however minute or trite they may seem, should not be overlooked, as they furnish the safest and most successful indications of cure, and are the beacons by which we are to be guided in the treatment of the disease."

No correct scientific name has been adopted for this disease. Dr. Farr proposes *trachealia*, as already mentioned, but it has not been adopted in the latest issue of nomenclature for the Army returns, Cullen's name being still retained. It is useful to know the name by which a disease has been known and described, more especially as progressive improvements are made in nosology, by the correct nomenclature of diseases. The name of *croup*, by which this disease has hitherto been known in this country, is of Scottish origin. Cullen's *cynanche trachealis*, and the more modern *tracheitis*, are objectionable terms, because they lead to false notions of the pathology of the disease. The "choak," "stuffing," "rising of the lights," and "hives," are all designations by which the disease has been described, and some of them are still names in vogue amongst the common people of the country.

The disease is almost peculiar to infancy and childhood; and there are two forms which can generally easily be distinguished from each other, but which are often confounded. One form is very manageable, the other very fatal. In the former variety the mucous membrane chiefly secretes mucus, pus, or mucopurulent fluid. In the more dangerous form an albuminous or fibrinous exudation grows upon the inner surface of the air-passages constituting the false membranes already described. The first form seems to be the one common in America, of which not more than *one* in *fifty* dies. The latter is the more common European form, of which the deaths used to be *four* out of *five*, and still are about *a half*. About one child, in twelve deaths of children, dies from this disease; and the ratio borne by croup, to 1,000 deaths from all causes, in 1854, was as 9-249.

Symptoms and Course.—The mildest form of croup differs from an ordinary catarrh only in the addition of spasmodic symptoms; but this form may run into the more severe form, so that it is not possible to determine, in the first instance, which form the disease may ultimately assume.

The catarrhal croup of Dr. Wood embraces the spasmodic as well as the catarrhal croup of Dr. Copland. Spasmodic action of the laryngeal muscles is, however, common to both, and is characteristic; but the inflammation and exudation is not in general more severe than that which attends a common catarrh.

The disease may be ushered in by sore throat, by catarrhal symptoms, or by a short dry cough, or it may occur *per se*, and without the general health being sensibly impaired. In either case the attack commonly takes place during the night, the sleep of the child, which was perhaps more or less agitated, being interrupted by fits of *hoarse* coughing. These become more frequent, the respiration more difficult, and marked by a peculiar wheezing, which has been described as like the sound of an inspiration forcibly made with a piece of muslin before the mouth, or like to the sound of air passing through a brazen tube. The little patient also feels a sense of restriction about the throat, as shown by carrying the hand often to it, and grasping the larynx. After the paroxysm has lasted some hours there is an interval of ease, which perhaps lasts for some hours.

By the end of the second or third day, sometimes sooner, the tongue becomes white, the heat of the body increased, the pulse frequent, the face flushed, and the countenance distressed. From this point the disease now rapidly advances, the croupy sound attains its height, and Dr. Home describes it as "*vox instar cantus galli*;" others have compared it to the noise which a fowl makes when caught in the hand; while the child often puts its fingers into its mouth, as if to pull away something which obstructs the passage.

As the disease draws towards a close the paroxysms become more frequent, the cough more severe, the pulse more rapid, suffocation more imminent, and the extremities cold and livid. The final close of the disease is often by convulsions, sometimes almost tetanic; and Dr. Ferrier once was present when the struggle was so violent that after death the corpse, in a great measure, rested on the occiput and on the heels.

Often, however, the symptoms are much more moderate: although it not unfrequently happens that symptoms of the severer form come on, indicated by a huskiness of the voice, all no sound can be heard above a whisper, by a muffled cough and a wheezing noise which attends the inspirations. It is seldom that children expectorate: but in happier cases than the above, mucus, tinged perhaps with blood, is coughed up, and later, perchance, the false membrane is detached and thrown up, and the patient recovers.

The croup which has been described is of the most acute kind: but in many cases its course is much more chronic, the symptoms generally milder, and the intervals of ease longer and more complete, during which the breath is free, the child cheerful, and the appetite good. In the course of a few days, however, a violent paroxysm seizes the child, and destroys him with every appearance of one strangled.

The internal fauces, as the tonsils, uvula, and velum pendulum palati, are sometimes seen inflamed and ulcerated; while in other cases the fauces are healthy.

According to Barth, on the stethoscope being applied to the larynx, we hear a sort of "tremblement," as if a moveable membrane was agitated by the air; and he considers this phenomenon as an unerring evidence of the existence of a false membrane in the larynx.

Laryngitis in the adult is marked by the same difficulty of breathing, the same lividity of countenance, the same constriction of the throat, the same paroxysmal attack, and by the same exemption from any severe constitutional affection. The voice, however, instead of being sharp and shrill, is generally deep and hoarse, although sometimes altogether lost—differences depending perhaps on the greater size of the glottis, and on the fact of the parts being the seat of ulceration, rather than of the effusion of lymph. At length the patient is cut off in one of the paroxysms. The duration of this disease, when acute, is short. The celebrated Dr. Pitcairn died on the fourth day from the first attack, and Sir John Hay, Physician to the Forces, died within the same period. More commonly, perhaps, the disease passes into a chronic state, when the patient may survive many weeks or even months. Several cases are on record of croup having terminated in twenty-four hours; more frequently, however, the child lives

to the third or fourth day, and in chronic cases much longer. From one day to one or two weeks may be given as the variable periods of the duration of this disease.

Diagnosis.—It is generally between croup and the following diseases:—namely, the different forms of sore throat, as in *scarlet fever* and *measles*, *diphtheria*, *bronchitis*, *chronic laryngeal and tracheal inflammation*, *whooping-cough*; and the differential symptoms of each of these from croup must be studied by comparing the definitions, symptoms, and course of each of these diseases, as well as the epidemic constitution as regards *scarlet fever*, *measles*, *diphtheria*, and *whooping-cough*.

Modes of Propagation.—Croup is said to be more frequent in cold and moist climates than in those which are warmer. It is also much more severe in Europe than in America; and its existence and progress is considerably influenced by changes of season, weather, and temperature. It is prevalent in Switzerland and Savoy, in the eastern counties of England and Scotland, the north-west countries of Europe, and in the northern parts of America. While the annals of medicine are rich in descriptions of epidemic and endemic croup, opinions are very much divided as to the nature of the epidemic influence, and whether or not the disease is contagious or infectious.

Age has, perhaps, the greatest influence in predisposing to the disease, and while rare in adults, it is seldom seen in early infancy. It is most prevalent between the *first* and *seventh* years of life. According to the experience of Dr. Wood, the disease appears to run in families, and vigorous fleshy children, with rosy complexions, are frequently those who suffer most.

Prognosis—"Is never better than doubtful." It is to be determined from the violence of the local symptoms and the frequency of the paroxysms, rather than from the constitutional symptoms. Children, however, seized with croup are said to recover in a smaller proportion in this country than in America. Death tends to occur by *apnœa*.

Treatment.—*Every case of croup demands the most active, efficient, and energetic treatment.* When the croup in children commences in the larynx, its course is so rapid and so fatal that the measures for its suppression must be early. Bleeding, and especially local bleeding, should be employed, and in most cases to a considerable extent (an ounce of blood for every

year of age);—and two to twelve leeches, according to the age of the patient, should be applied over the larynx. After these have fallen off, the bleeding should be encouraged by the application of a lintseed poultice to the throat. This first bleeding often gives great relief, and sometimes stops the disease; but if not, the leeches, after a few hours, may be repeated. As soon as some relief is obtained a blister should be applied, and, after that is removed, the part should be dressed with strong mercurial ointment. In addition to bleeding and blistering, many practitioners prescribe *emetics*; first, because their emetic effects, and the large evacuations they produce, favour the resolution of the inflammation; and again, because the effort of vomiting may be the means of detaching and of expelling the false membrane, should it have formed. If relief does not ensue on the action of the emetic, Dr. Cheyne recommends *two, three, or four grains of calomel, with two or three grains of James's powder, to be given at short intervals every two or three hours; and a dose of castor oil is to be given occasionally till the full effect of the calomel as a purgative is obtained. Green fæcal stools, like chopped spinach, are characteristic of this result.*

Bleeding, blistering, and mercury, although the rule of treatment in idiopathic infantine croup, are, for the most part, entirely inefficient in those cases in which the affection begins in the fauces, as in the case of many epidemics, and especially after scarlatina. In these cases the best treatment, if the false membrane be not already formed, is to relieve the throat by the application of a few leeches, as in scarlet fever, and then to support the little patient with a moderate quantity of wine diluted with water. If the false membrane has formed, perhaps an emetic affords the only chance of relieving the patient; and, indeed, so soon as croupy cough and dyspnœa occur, an emetic of *ipecacuanha* with *tartar emetic* ought at once to be given in doses suited to age. Four to six grains of *ipecacuanha*, combined with a quarter or a third of a grain of tartar emetic, will be found sufficient for a child of two or three years of age. The action of the emetic may be aided with benefit by a warm bath of 98° to 100° Fahr. in temperature. If it becomes obvious that the exudation has assumed the form of a membrane, especially if indicated by a diphtheritic coating over the fauces, a solution of the nitrate of silver varying in strength from two scruples to two

drachms to the fluid ounce of distilled water should be applied to as much of the fauces and larynx as can be reached. A sponge on the end of a piece of whalebone, as sold by the instrument makers ready made, should be loaded with the weaker solution and squeezed against the *rima glottidis* two or three times a-day. Bleeding has no effect in removing or modifying the false membrane; but the system must be brought as speedily as possible under the influence of mercury. Mercury appears a powerful resource in these cases; and, introduced either internally or by inunction, so as to affect the mouth, uniformly gives relief as soon as the constitutional affection is established. Unhappily, however, the amelioration is too often transitory; for almost as soon as the mouth is healed the symptoms return, and the patient again lies in imminent danger. Another salivation may produce another cessation, equally temporary, and the patient may ultimately die.

Expectorant medicines should be given with the mercurials, and be continued after them. *Ipecacuanha* and *seneka* have the most efficient influence over the mucous membrane.

Five grain doses of iodide of potassium every two hours; and of chlorate of potassa, have been used with benefit; and the use of a vapour bath from 75° to 80° Fahr. is not to be neglected (BUDD).

The medical treatment of croup is so frequently unsuccessful that tracheotomy has often been had recourse to as the means of prolonging life, and consequently, as affording an additional chance of the patient's recovery. Guersent has performed this operation repeatedly at the Hôpital des Enfants, but almost always without success. On the other hand, M. Trousseau states that he has saved one-third of his patients by its means, and of twenty cases Bretonneau saved six. Perhaps the experience of the profession, generally, is equally discordant on this point at this moment; for those who operate early contend they save some portion of their patients, while those who wait till a case is advanced and beyond medical treatment before they resort to this measure, for the most part lose all their patients. The evidence, however, is daily accumulating which shows that tracheotomy ought to be resorted to much oftener, as a remedy for croup, than it has hitherto been, and that *at a much earlier period in the disease,—not as a last resource, when death from asphyxia*

appears imminent, and after treatment of the most depressing kind. That this is the secret of success in France and in this country, is shown by the experience of able physicians and good surgeons, of whom the names of M. Trousseau, the late Mr. Jones, of Jersey, Mr. Henry Smith and Dr. Fuller, of London, the late Dr. Cruickshank, of Dalmellington, in Scotland, and Mr. Spence in Edinburgh, may be stated as authorities by experience. In country districts the performance of tracheotomy in a case of croup is almost imperatively called for in the majority of cases, *if some symptoms of amelioration do not follow the steady use of bleeding emetics, the warm bath, and calomel purgation, pursued for twelve or sixteen hours.* I know that in a wild country district of Scotland, where croup was very common and fatal, the late Dr. Cruickshank saved eight out of eleven cases during two years. A valuable paper by Mr. Smith, in *The Medical Times and Gazette*, 26th January, 1856; another by the late Mr. Jones, of Jersey, in the 8th November of that year; and lastly, a paper by Dr. Conway Evans, in the *Ed. Med. Journal* for Jan. and May, 1860, go to support the same conclusion—namely, that an earlier introduction of air, by the operation of tracheotomy, for croup, would not only give us a larger per centage of recoveries in this country, but would place the operation in the same favourable light in which it is now regarded in Paris and other parts of France. The cause of death after the operation is often extremely perplexing, for the patient, whether a child or an adult, often revives, breathes freely, and the local inflammation, from the use of the knife, is generally trifling, and yet the patient dies. Some physicians attribute this result to congestion and disease of the lung itself; but as the patient often lives for three or four days tranquil, and almost without cough, this hypothesis does not appear satisfactory. Abscess in the anterior mediastinum pleuropneumonia and pericarditis have been found after death. The fatal result, therefore, seems rather to depend on a cause acting generally on the system, and which ultimately destroys the patient. This cause gives a difference of type to the disease in this country from what it has in France; but as this difference appears, in the first instance, to be aggravated by the obstruction to the passage of air, there is thus a still more powerful reason why the operation of tracheotomy must be resorted to early. Age also seems to influence success to a considerable extent. Under

two years of age few cases recover; but between the ages of six and twelve nearly one-half are saved (CONWAY EVANS).

DYSENTERY—*Dysenteria*.

Definition.—*A specific febrile disease, accompanied by tormina, followed by straining, and scanty mucous or bloody stools, which contain little or no faecal matter. The minute lenticular and tubular glandular apparatus of the mucous membrane of the large intestines, with the intertubular connective tissue, are the chief seats of the local lesion, which sometimes extends into the small intestine beyond the ileo-colic valve.*

Historical Notice, Pathology, and Morbid Anatomy.—Dysentery is a disease which varies considerably in different countries and localities, and sometimes also in apparent accordance with the supposed exciting cause, or prevalent "epidemic constitution." Sporadic cases, which now and then occur in our large towns, are not generally so violent, and are less fatal than the epidemic cases, or those which occur in tropical climates. The effects on the constitution are no less varied and severe.

Dysentery has at all times proved one of the most severe scourges of our fleets on foreign stations, and of our armies in the field, even during campaigns in temperate regions. It is sometimes so prevalent that it exceeds the number of sick from all other diseases put together. It has followed the tracks of all the great armies which have traversed Europe during the Continental wars of the past 200 years. It helped to destroy the British army in Holland in 1748. It decimated the French, Prussian, and Austrian armies in 1792. It was a chief cause of death in the ill-fated Walcheren expedition in 1809. It cut down the garrison of Mantua in 1811 and 1812. Sir James Macgriggor records how fatal the disease was in the Peninsular campaigns; and we know how disastrous it was to our troops during the first winter they passed in the Crimea, in 1854. In the words of Sir Ranald Martin, "It is the disease of the famished garrisons of besieged towns, of barren encampments, and of fleets navigating tropical seas, where fruits and vegetables cannot be procured. During the Peninsular war, the first Burmese war, and the late war with Russia, *dysentery* was one of the most prevalent and fatal diseases which reduced the strength of the armies."

It is a dangerous and frequent disease throughout our inter-tropical possessions, as the following tabular statement, furnished by Sir Alexander Tulloch to Sir Ranald Martin, sufficiently testifies:—

*Prevalence and Mortality of Dysentery in various countries, by
Sir Alexander Tulloch, K.C.B.*

STATIONS.	Period of Observation.	Aggregate Strength.	DYSENTERY.		
			Attacked.	Died.	Proportion of deaths to admissions.
Windward and Leeward command,	20 years.	86661	17843	1367	7.7 per cent.
Jamaica,	20 "	51567	4909	184	3.7 "
Gibraltar,	19 "	60269	2653	64	2.4 "
Malta,	20 "	40826	1401	94	6.6 "
Ionian Islands,	20 "	70293	3768	184	4.8 "
Bermudas,	20 "	11721	1751	36	2.0 "
Nova Scotia and New Brunswick,	20 "	46442	244	18	7.4 "
Canada,	20 "	64280	735	36	4.8 "
Western Africa,	18 "	1843	370	55	14.2 "
Cape of Good Hope,	19 "	227111	1425	44	3.0 "
St. Helena,	9 "	8973	751	69	9.0 "
Mauritius,	19 "	30515	5420	285	5.2 "
Ceylon,	20 "	42978	9069	993	11.1 "
Tenasserim Provinces, ..	10 "	6818	1460	137	9.3 "
Madras,	5 "	31627	6639	559	8.3 "
Bengal,	5 "	38136	5152	411	8.0 "
Bombay,	5 "	17612	1879	151	8.0 "

In England generally, however, *dysentery*, as a cause of death, has been decreasing since 1852, although about 200 years ago it was one of the most prevalent and fatal diseases of London. Yet still, although the disease is less violent and less fatal (for as a cause of *death* it has remarkably diminished during the past ten or twelve years), and although the unfavourable hygienic conditions which were wont to bring about dysentery no longer exist, the active endemic conditions which favour, promote, or are congenial to its development are only dormant, and not eradicated. The disease, therefore, is still sometimes brought about just as in the days of Sydenham or Willis. In no respect, however, do we find that the dysentery of this time differs essentially from the description given by Sydenham more than a hundred and thirty years ago. When we look, therefore, to the history of the disease, and to the nature of its lesions—to its re-

appearance from time to time among us, with the same identical characters—there are strong grounds for believing that there is something specific in the nature of the poison which produces dysentery, just as specific as that of *small-pox*, *typhus fever*, *typhoid fever*, *scarlatina*, *ague*, or *diphtheria*. But besides the specific identity of the disease, as it now exists, with the disease of former times, there is another point of view from which the history of the pathology of dysentery is especially instructive. It is this:—like all diseases which have been at the same time epidemic and severe, it has been the subject of discussions as frequent and as varied as its ravages have been severe; and one single description of the disease will not do for a record of the characteristics of all epidemics. Most minute descriptions of the state of the intestines in dysentery have been given by many writers; but as Dr. Copland justly observes, from his extensive experience, “Dysentery is neither so simple in its nature, nor so unvarying in its seat and form, as some recent writers in this country have stated;” and “that writer will but imperfectly perform his duty who, in giving a history of a most prevalent and dangerous malady, confines himself to the particular form it has assumed during a few seasons, within the single locality or the small circle of which he is the centre, and argues that it is always as he has observed it.”

Dysentery is, moreover, a most formidable disease, especially on account of its oftentimes insidious nature, from its tendency to recur, and from the after-influences it exerts on particular organs and on the system at large. For these reasons almost all writers on the diseases prevalent in tropical climates place dysentery at the top of the list of severe affections, and refer to it as the cause and origin of many of these chronic and intractable abdominal diseases which so often afflict Europeans resident in tropical climates.

The disease presents a variety of forms both as to the rapidity and severity of its course, as well as to the anatomical peculiarities which characterize its pathology; and hence opinions as to its nature have been very various, because historians have assumed that the disease has always been as they have described its occurrence in a limited locality and at certain seasons. Hence, also, the morbid anatomy of dysentery is not yet clearly understood. Medical science has not yet finally

settled many points in the pathology of the disease, consequently the doctrines as to treatment are somewhat uncertain; while the means of prevention are not less imperfectly defined. It has been usual to describe cases of *dysentery* as being either *acute* or *chronic*; but there are also cases belonging to a third class which may be termed *complex*.

Acute Cases of Dysentery.—In this form the inflammatory action does not confine itself to the tissues of the mucous membrane only. The serous covering of the intestine, or even such solid viscera as the liver, spleen, kidneys, are also involved in a disease-process. Ulceration or sloughing of large portions of mucous membrane and exudation go on together, and there may be very little corresponding fever at all commensurate with the severity of the lesions, so that while the disease is acute, it is at the same time, in many instances, of a masked and almost latent nature. Death frequently takes place within the first ten or twelve days in such cases; but the disease may terminate gradually and spontaneously, or as the result of appropriate treatment, by the end of the third or fourth week. On the other hand, the disease may not end so favourably and early; but, evincing a marked and obvious resistance to treatment, may advance unchecked; the morbid changes being slow in progress, often extending over several months, and then the case passes into

Chronic Dysentery.—One of the most hopeless and intractable forms of disease which the physician has to treat. Under the influence of the slow morbid changes about to be noticed, the wasting of the tissues of the patient progresses steadily, till a human form, literally reduced to the state of a living skeleton, whose bones are held together by skin and ligament, is all that remains. The skin acquires a dry bran-like furfuraceous aspect, and the epithelium desquamates in scales and powdery particles.

During the progress more especially of chronic cases, various intercurrent morbid states become developed, not necessarily connected with the primary affection, but forming secondary lesions to the disease, and constituting the third form in which *dysentery* must be studied, namely,

Complex Cases of Dysentery.—There are various secondary lesions which render cases of dysentery complex, and which are regarded

by some as directly connected with the primary affection. There are also secondary lesions connected with antecedent forms of disease, which sustain a renewed impulse to their development by the dysenteric state. These secondary lesions may be shortly stated to consist,—(1.) In lesions of the small intestines, and of various solid viscera, more or less connected with the dysenteric state; and (2.) In lesions which may be referred to the co-existence of certain morbid states of the patient with the dysenteric condition, such, for instance, as the *typhous*, and *scorbutic*, and the *tuberculous* state.

Anatomy of the Morbid Tissues in Acute Dysentery.—The accounts of the morbid anatomy of dysentery are especially confusing; and while the disease has been mainly recognized during life, and defined as a febrile disease accompanied by tormina, and followed by straining and scanty mucous or bloody stools containing little or no faecal matter, yet the local lesions associated with these conditions have not been so clearly defined nor uniformly described. For example, Chomel and his school considered that the local lesion in dysentery consisted in congestion simply, and tumefaction of the mucous membrane, especially in patches of some extent, so as to form dark red or purple prominences, from the surface of which the epithelium becomes detached by desquamation.

Cruveilhier believed that dysentery was an erythematous inflammation of the large intestine, quickly followed by sphacelus; and he emphatically insists on the point that the follicles and solitary glands have no share in the disease. "It is not," he says, "a follicular inflammation."

Rokitansky includes these two forms of lesion as essential in dysentery; and the disease, as described by all these observers, is regarded as a process of rapid, and at first of superficial inflammation, leading inevitably and speedily to mortification, and unattended by any special disease of the solitary glands. Rokitansky states that, even in the slightest variety of dysentery, the mucous membrane is swollen and red, and may be removed in the form of a pulp from beneath the furfuraceous and vesicular epithelium. In after stages, and in the severer forms, the mucous membrane becomes gelatinous and is easily separable, or it passes into a state of sphacelus, black, friable, and offensive. All these observers regard ulceration as having no essential part in the

disease-process which constitutes dysentery, and as being of very rare occurrence.

Some of the writers who have described the tropical forms of the disease have been still less distinct as to the details of its morbid anatomy. For example, Twining seems to have followed Chomel in considering the lesion to be a simple inflammation of the mucous coat; and Annesley is in a great measure unintelligible as to the points of morbid anatomy which he describes. It was not till Dr. Parkes published his minute and admirable description of the morbid anatomy of dysentery, as he saw it in India, that we had anything definite on the subject as regards the tropical forms of the disease. He not only showed the very early implication of the glandular apparatus of the great intestine in dysenteric inflammation, but he established the fact, so far as his cases went, that, while ulceration occurs with great rapidity, a case never presents true dysenteric symptoms without ulceration being present. At Moulmein, in India, he investigated, in 1843-44, cases of dysentery in Europeans to the number of fifty, and in Asiatics to the number of twenty. He concluded from these observations that,—(1.) Certain alterations in the glands of the mucous membrane of the large intestine, and sometimes of the ileum, constitute the earliest lesion in dysentery. (2.) That in all cases when not too far advanced, the mucous membrane presented the appearance of numerous whitish round elevations, of a size varying from a millet-seed to a size so minute that a lens only can show the lesion. These elevations were hard, and being pierced, gave forth a white excretion. Many of these had a black speck in the centre, and were surrounded by a vascular circle. (3.) He noticed that exudation sometimes occurred in points beneath the mucous surface; that such points of exudation had a white appearance, with contents similar to those of the solitary glands. The mucous membrane over these points could be rubbed off, leaving an ulcer. (Parkes *On the Dysentery and Hepatitis of India*.) The observations of Dr. Parkes were thus opposed to the views just stated, and led to extended investigation, by which such contradictions might be reconciled; and first, it was determined that differences of climate do not cause any essential difference in the structural changes which accompany dysentery. The observations of Drs. Craigie and Abercrombie in Scotland, in 1837, prove this; and also those of the late Dr. Baly in

1847 as regards England. Drs. Cheyne, Graves, and Mayne have demonstrated the same fact as to Ireland. By the records of epidemic dysentery at Prague and elsewhere, as described by Dr. Finger and others, the observation holds true as regards the dysentery of Europe generally; and by comparing these records with the well-recorded cases of those who have seen the disease in the tropics, both in civil and in military life, it will be seen that the true dysentery of tropical and temperate climates does not differ *as to its anatomical signs* in any essential particular.

The descriptions of the disease in our own country, as given by Cheyne, Craigie, Abercrombie, and Baly, all agree in recording the inflamed condition of the mucous membrane of the colon, with its small round ulcers, pulpy softening, or sphacelus of some portions, and ulcers of various forms left by the separation of the sloughs, and enlarged firm tubercles, which no doubt were the inflamed solitary glands. Again, Sir John Pringle, M. Broussais, and other historians of dysentery, found the same lesions in the dysentery of the camps in the continental campaigns of Europe; and Broussais expressly states his belief "that the ulcers of the large intestine had their origin in the solitary glands." Thus the "tubercles," the "pustules," and the "small-pox-like elevations," of the mucous membrane, have been most minutely described by Hewson, Pringle, and Davis; and the last of these observers describes, in graphic language, the fatal dysentery of the Walcheren expedition, and shows that its anatomical characters are similar in all respects to the dysentery which has been described in this country.

We have therefore only to compare all these records with the histories of tropical dysentery, as given by Zimmerman, Annesley, Pringle, Copland, Dr. Hunter, Chisholm, Ballingall, Parkes, Morehead, Sir Ranald Martin, Tait, Macpherson, and others, to know,—"whether any peculiar character of the anatomical changes in the large intestine essentially distinguishes the dysentery of intertropical countries from the dysentery of this and of other temperate regions." Dr. Abercrombie admitted identity in the nature of the dysentery; but, that extent of the intestine affected varies considerably. Dr. Craigie showed that the lesions in dysentery occur in two forms: one continuous over the surface,

the other limited to the *muciparous follicles*, which become enlarged, indurated, and ulcerated; while, on the other hand, Dr. Baly has shown that all the well-marked varieties of structural change in the large intestine occurring in tropical dysentery, are likewise found in fatal cases of the disease occurring in our own country.

Seeing, then, that the descriptions of the morbid anatomy have been so much at variance with each other, several questions suggest themselves, namely,—(1.) Whether distinct epidemics are characterized by distinct local lesions? (2.) Whether two or more distinct diseases have not been confounded under the one name of dysentery? Or, (3.) Whether the various local lesions described by different writers are only so many varieties, forms, or types of the same disease-process—a process modified in particular cases by constitutional peculiarities, or by other circumstances. This latter view is the one most consistent with observation; and it is in accordance with what we know of the history of many of the *miasmatic* diseases, such, for example, as *true yellow fever*, *remittent fever*, *diphtheria*, and the like. There is some evidence also to show that there is a lesion of the colon not belonging to true dysentery—a *colonitis*, in which the connective tissue of the gut beneath the mucous membrane is implicated in the first instance, rather than the glandular tubes and vesicles. The result is a diffuse gangrenous inflammation of the mucous membrane, the resulting ulcers not differing from the ulcers originating in the glands by any characters at present recognizable (COPLAND, PARKES).

In this country it is believed that the lesion in dysentery is confined, for the most part, to the colon and rectum; but that in tropical dysentery the whole course of the colon, and sometimes a considerable portion of the small intestines, are implicated. Lesions so extensive, while they are common in India, are rare in this country; yet they do occur, and are not uncommon in the south of Europe, in Turkey, and the coasts of the Mediterranean. Therefore, as regards the extent of the lesion, there is no constant or distinctive characteristic between tropical dysentery and the dysentery of more temperate climates.

In both regions the anatomical changes comprehend redness of the mucous membrane, preceding further changes; loss of the substance of the mucous glands by pulpy softening of tissue,

sloughing, or ulceration; the detachment of diphtheritic casts of the intestine, or sloughs of tissue.

In describing the morbid anatomy of dysentery the reader is referred to the nomenclature of the gland structures, given in a footnote at page 369 of the present volume. The structure of the colon in the healthy state differs in many important particulars from that of the small intestine. It is remarkable in the absence of folds and villi, and in the presence of more or less dilated sacculi, which give form and shape to the excrement. The minute tubular glands are thicker in proportion to their length, compared with those of the small intestine; and the intertubular connective tissue is considerable,—a structure which takes an important share in the lesions of dysentery. These tubular glands are lined by columnar, cylindrical, and transition forms of epithelium; and the solitary lenticular glands are sometimes closed vesicles (ALLEN THOMSON, PARKES, BALY), and sometimes open follicles. When closed, they are not visible; but if distended, they may be seen with a lens; and when open, a dark depressed point marks the separation in the tubular gland structure which leads to the open follicle. The tubular glands radiate round this spot, which corresponds to a depression indicating the empty vesicle below. These solitary vesicles have thick walls, and are said to be more abundant in the cœcum and rectum than in any other part of the great intestine. This statement leads to the question which has been mooted in relation to these solitary gland lesions, namely,—“Are these lesions of the so-called solitary glands really due to the enlargement of previously existing solitary glands or their germs? or; Are they new formations altogether?”

A similar question is at issue regarding the granulations on the eyelids and conjunctivæ, associated with purulent ophthalmia (STROMEYER, FRANK, MARSTON). In this disease we have *new formations* of vesicular-like granulations, as well as enlarged follicles; but these are more numerous than the glands have ever been seen to exist in the healthy state. Observations somewhat similar have been made regarding the vesicular glands of the stomach (HANDFIELD JONES). It may be, therefore, that not a few of the “tubercle nodules,” the “pustules,” the “small-pox-like elevations,” and what we call solitary or lenticular glands, are in reality new formations altogether, resulting from increased

cell-growth, within the meshes of the connective tissue which binds the mucous gland tubes together, and connects them with the submucous layer of muscular tissue. In this respect their formation would be analogous to that described by Virchow in connection with tubercle, and not to be distinguished histologically from a newly formed grey tubercle nodule. So independent have these lesions been believed to be by some, that one observer of Indian dysentery (MURRAY) described a "pustular form of dysentery," which he considered to be in all respects analogous to small-pox on the skin, beginning with the formation of an independent papule and the development of a subsequent pustule, as in that disease of the skin. This view of the subject is of some importance in pathology, as it is related to the specific nature of dysentery and the poison cast off from the mucous membrane, by which it is believed that the disease is propagated like typhoid fever and cholera (DR. WILLIAM BUDD).

Seeing, therefore, that the anatomical signs of dysentery are so constant over all the world, it may be asked, How have modern writers given such contradictory accounts of the morbid anatomy of the disease? The best writers have differed on points of observation simply,—(1.) Some deny the necessary occurrence of ulceration; (2.) Some deny any special participation of the lenticular glands; (3.) Some believe that new formations arise, which are similar in appearance to those small glands; (4.) Some, on the other hand, believe the disease, at its commencement, to be always seated in these small glands; (5.) Some regard dysentery as essentially an erythematous inflammation, terminating in gangrene; (6.) Others believe that such gangrene is a very rare variety of the disease.

To explain such discrepancy, it may be said that,—(1.) Observations have been too limited, and not exact enough, to give an accurate and comprehensive view of the morbid anatomy of the disease; that dysentery, although a simple and uniform disease, so far as its anatomical signs are concerned, yet it is liable to constant changes of type, from its remarkable proclivity to complicate prevailing fevers (specific or endemic), as well as other diseases (*e. g.*, *typhoid fever*, *malarious fevers*, *scurvy*, *syphilis*, *phthisis*, *measles*, *variola*, and the like); (2.) The healthy or normal anatomy and histology of the mucous membranes are only yet beginning to be understood and studied

minutely at our Schools of Medicine; (3.) The examination of the colon, upon which descriptions have been based, has often been incompletely done, as Annesley very correctly pointed out; (4.) The inherent difficulties of the subject itself, such as the impossibility of seeing the state of the diseased membrane till after death. From all the observations that have been made, there can be no doubt that the anatomical signs of true dysentery are primarily derived from inflammation of the solitary lenticular follicles of the large intestine, tending in the first instance to infarction (*i. e.*, intumescence and congestion), and subsequently to ulceration and destruction of the gland tissue. The disease extending by a similar process, ultimately involves the tubular glands of the general mucous membrane, which tend to soften and to be cast off as an exuvium or slough, exposing the submucous connective tissue or the muscular coat of the intestine. It is the mucous membrane of the great intestine, and especially of the rectum and lower portion of the colon, which is the seat of these characteristic lesions in dysentery. The exudative process is generally diffuse, involving the whole of the tissues of the mucous membrane. In some cases, however, it is seated in the solitary glands, in the first instance, and neighbouring mucous tubular glands.

The morbid anatomical states which I have been able to distinguish throughout numerous dissections of cases of dysentery, may be stated as follows:—

1. Forms of exudation obvious on the surface of the mucous membrane of the rectum and colon.

2. Forms of exudation not obvious to the unaided eye, but which were seen, in all the cases examined by the microscope, to fill the mucous tubular follicles of the large intestine.

3. Forms of exudation obvious to the eye, and demonstrable by microscopic examination as being developed in the solitary vesicular or lenticular glands of the large intestine.

4. Changes in the exuded material, which tend first towards its organization, and subsequently to its destruction and removal by ulceration.

5. Softening and ulcerative changes in the tissues of the mucous membrane itself, and in the glands.

6. Similar dysenteric lesions extending into the *small intestines*.

The extent of the exudative process varies much. In some cases a considerable portion of the *colon* and *rectum* only is affected; in other instances not only is the whole tract of the great gut the seat of some form of the exudative process, but the lower portion of the small intestine also. The most commonly affected portions, however, are the *rectum*, the *sigmoid flexure*, and the *descending colon*. When the *caput cæcum* of the colon is involved, the *vermiform appendix* participates in the process. Creamy-like exudations have been seen to fill its tubular glands, which in some cases were opened up by ulceration.

In the least severe cases an opportunity does not often occur to see the changes in an early stage; but when life is cut short by some other malady, changes of the following nature may be seen:—

The exuded material, in its more recent state, forms a layer, which varies from a thin but opaque membrane to three or four lines in thickness, of homogeneous substance, tolerably consistent, and capable of being detached and raised in flakes from the subjacent mucous surface. During the earlier stages of the disease the surface of the mucous membrane appears unchanged below, except, perhaps, by the existence of a little increase of vascularity. The colour of the exuded matter may be uniform or red, white, or pink in patches, and discoloured in some instances by intestinal gases, the biliary secretion, or by the admixture of blood, and the changes consequent thereon. The most common appearance in severe cases is that of a dark olive-green passing into a bluish-black. The surface of the exudation may be uniform, or the whole aspect may be mammillated, with here and there a *mammillation* projecting greatly above the others in a fungating mass, surrounded by dark fissures in the exudation. These fungating masses are soft towards their centres, with numerous red vascular points here and there on the surface. A section through the mass shows the base thickened and firm.

The dysenteric process, as seen after death, is generally found to have advanced farther in one part of the intestine than in another; usually, it may be stated to have been farther advanced in the *rectum* than in the *descending colon*, and farther in that part than towards the head of the large intestine. In well-marked and extreme cases the entire mucous surface, from the *caput cæcum* to the *rectum*, may be seen to present all the pos-

sible stages of the dysenteric process. Three stages can in general be distinguished, namely,—(1.) Ulceration of the exudation, and mucous membrane more or less advanced towards the *rectal end* of the great intestine; (2.) Exudation in various forms towards the *middle* of the *colon* upwards from the *rectum*; (3.) The exudative process visible microscopically in the tubular glands, and sometimes also obvious to unaided vision in the solitary vesicular glands of the great intestine towards the *caput cæcum*.

One of the best descriptions of the morbid anatomy of dysentery in the English language has been given by the late Dr. Baly in his *Gulstonian Lectures* for 1847. He describes *three* different forms of lesions as seen by him amongst convicts at the Millbank Prison; and these three forms he believed to correspond with three degrees of severity of symptoms during life,—(1.) He recognized a swollen condition of the solitary glands, forming round prominences on the surface of the mucous membrane, of very various sizes. In colour these were pale, or red round the base, and dotted at the summit with a vascular spot. These appearances would occur about the eighteenth or twentieth day. At an earlier period the congestion round the glands would be more intense; while at a later period the summits of the prominences would become disorganized. Minute yellow sloughs subsequently form, which, becoming detached, leave an ulcer previously occupied by the gland. The mucous membrane around participates in the process. It is red, tumid, and covered with an aphthous layer of lymph, to the extent of one or two inches around, with three or four solitary glands prominent in the midst. The ulcers which form result from sloughs rather than from ulceration; and the disease still remains *not severe* as regards the amount of tissue involved; but *as to duration* the illness may be prolonged and tedious; and the solitary gland cavities may enlarge very much—so large as a horse-bean. (2.) In more severe forms a greater variety and extent of tissue is involved; and especially of the tubular glands. There is great redness, tumefaction, and softening of tissue; and along with the change of colour and of texture the secretions are greatly altered. The clear mucus is highly charged with albumen, and subsequently with blood.*

* Some account of the chemistry of the stools in dysentery has been given by Oesterlen, who describes an excessive elimination of water and of albumen; and it has been suggested how very desirable it is that this observation should be verified in

These changes occupy principally the prominences of the transverse rugæ. The exudation on the free surface in the recent condition may form a thin opaque membrane three or four lines thick. It is homogeneous and of considerable consistence, so that it may be detached and raised in flakes from the subjacent surface. With the exception of increased vascularity, the subjacent mucous surface appears still unchanged. A microscopic examination of this exudation shows that it varies with the severity of the case to some extent. In mild cases it is simply particles of epithelium mixed with amorphous granules. In more severe forms the exudation consists of fine germs with nuclei, mixed with elongated cell-forms (connective tissue cells); and the examination of carefully prepared sections shows that such exudation mainly commences in the tubular glands, and by proliferation subsequently spreads over the mucous surface as described.

Exuviae, or casts of the intestine, may now be thrown off in large masses or shreds, leaving a raw-looking vascular surface underneath; and in some respects this process and these casts are analogous to similar phenomena in *croup*, *diphtheria*, *dysmenorrhœa*, and to *typhoid fever*. By carefully examining the evacuations important information may be obtained as to the nature of the process going on in the intestines. Dr. Goodeve, of Calcutta, has made some valuable observations of this kind. He recommends that the evacuations should be washed with water, so as to get rid of the fæcal matters entirely, and so leave the sediment, which is the product of the colonic disease, free from bile, fæcal matter, and offensive smell. He observed that patches of membrane, half an inch or an inch or more in size, are cast off as sloughs. These exuviae are thin, membranous, and sometimes infiltrated with pus; or they are thick and of a yellowish-brown colour. It is not till after the *eighth* or *twelfth* day of the disease that such sloughs are cast off. In these respects they may be considered similar to those cast off from Peyer's patches in typhoid fever. After these shreds are cast off the symptoms diminish, and the patient often gets well rapidly.

India. The stools should be collected free from urine; and the albumen should be estimated separately from any insoluble sediment. If in severe cases two and a-half ounces of albumen are passed in twenty-four hours by stool, it is impossible to over-estimate the importance of such an occurrence.

During the shedding of the shreds the patients are much griped, and they pass with straining the sanguinolent masses, or slimy mucous in small quantities, and generally without fæcal matter, fifteen or even twenty times a-day. Then a period of cure and improvement supervenes, with diminution of the stools or of the fæcal discharges—not simply by resolution, but a termination by elimination of the specific sloughs or lesions which have formed in the course of the disease. In this respect the phenomena seem analogous to what occurs in typhoid fever. When these membranous flakes are not shed, but retained and ultimately separated in large pieces, there is considerable danger attending the process. Discharges of blood and fatal hæmorrhages may ensue. Morehead records eight cases of this kind in India, and four of them were fatal, of whom one died from hæmorrhage. To account for this hæmorrhage, it has been observed that changes go on between the intertubular connective tissue and the substance of this exudation, which tend to its organization or supply with blood, and subsequently to its destruction, separation, or removal by ulceration. In vertical sections, down to and through the mucous membrane, I have seen fine blood-vessels in loops and bulbous cœcal ends, shooting upwards beyond the mucous surface into the exudation; and when such exudation was forcibly removed from off the mucous surface, the membrane on which it lay was found to be highly vascular, and numerous minute ruptured vessels showed their torn mouths, by minute points of exuding blood. Dr. Morehead records a similar observation as regards the connection of the exudation with the subjacent mucous tissue, “through the medium of what appeared to be small capillary vessels, the mucous membrane beneath being vascular.” (*Researches on Disease in India*, p. 241.)

When such a state of vascular action in the mucous membrane and exudation has existed for a lengthened period, the tissue of the gut becomes greatly thickened, and, at the same time, less coherent. These thickened portions grow luxuriantly, just as some patches in a field of green corn grow more luxuriantly than others, being supplied with a greater amount of nutritive material. These thickened masses of dysenteric exudation continue to fungate and grow from a hardened base, from which the numerous blood-vessels pass into the growing masses. In this way the warty condition of the mucous membrane in chronic

cases may result. The new material evinces a disposition to contract. The calibre or bore of the gut gradually contracts, and its texture becomes so brittle that slight force in pulling up a piece of such intestine out of its place will readily cause it to *break* asunder.

As to ulceration, it may be readily understood, with such varied lesions, that the formation of ulcers does not take place in any uniform mode; and the following statement is given as a summary of the processes from which ulceration may proceed:—(1.) It may occur after intumescence, softening, and simple ulceration of one or of several lenticular solitary glands. (2.) After intumescence, softening, and sphacelus of many solitary lenticular glands and the intervening tissue in one mass. (3.) After softening of the tubular structure and the detachment of sloughs, ulceration follows the intumescence and proliferation of growths from the tubes which cover the surface as a “croupous,” “catarrhal,” or “diphtheritic” exudation, and to which the name of “aphthous erosions” has been applied. (4.) After submucous inflammation and new growths, with fibrinous and mucinous effusion. (5.) After intertubular inflammation, and inflammation surrounding the base of inflamed glands. (6.) After the formation of submucous abscess. (7.) By changes of an ulcerative nature, commencing in the vascular exudation itself.

The *circular* ulcers, for the most part, originate in the solitary glands (PARKES, BALY), or in circular patches of tubes (MOREHEAD), similarly to the stomach ulceration, as described by Drs. Handfield Jones and Brinton; or such circular ulcers may result from both, as when a solitary gland is destroyed it carries with its destruction some of the adjacent tubes. In such cases the colon presents prominent little masses, about the size of a pea, which burst readily on pressure, and give forth fluid contents like pus. Such abscesses may open spontaneously upon the mucous surface through the short canal leading from the vesicular gland (now an abscess), imbedded in the submucous tissue, and between the tubular glands. They undermine the tubular gland substance, and carry off shreds or patches of the surrounding tissue. They may thus be seen in all stages, and sometimes almost symmetrically arranged in a double row along the colon (BLEEKER, MOREHEAD). Many of these little abscess cavities are also formed below patches of thick exudation (HASPEL).

The *transverse ulcers* are due to the transverse arrangement of folds, on which the exudation and textures ulcerate, as already described; and I have known the transverse *rupturing* of very thick exudation mistaken for ulceration, on seeing the raw vascular surface of the tissue exposed below, at the bottom of the rent.

Microscopically the exudation in its most recent condition may be seen to be composed of fine germs and nuclei, with elongated nuclear cells. It appears to be chiefly exuded into the follicular and tubular apparatus of the mucous membrane, and gradually accumulating there, is pushed upwards to the mucous surface, which it finally overspreads as a whitish coat, coherent and uniform, susceptible of vascular organization, and tending to ulcerate.

Anatomy of the Tissues in Chronic Dysentery.—In the true chronic form of dysentery the exudation already noticed undergoes various changes. It may be thrown off from the mucous surface altogether, leaving that surface bare and raw-looking, as if ulcerated; but a close inspection will show that the surface is entire and highly vascular. If it is not thrown off it may undergo a considerable amount of organization; after which it appears that a process of ulceration may be established upon its surface, just as in any other soft tissue. This ulcerative process may extend through the whole exudation, even to the surface of the mucous membrane, which it may penetrate also, and involve the tissues of the intestine in the ulcerative process close to the peritoneal coat. Perforation of the peritoneum is by no means uncommon.

In the chronic forms of dysentery there is a very constant morbid change to be observed, consisting in the deposit of black granular matter on some parts of the mucous membrane. It may be regarded as the result of excessive vascular action, and of subsequent changes in the extravasated blood, elements which mark the site of the melanic spot (pigmentary degeneration; see page 111).

The sigmoid flexure of the colon is perhaps the most frequently and the most extensively diseased, which is most expressed towards the rectum. In very severe cases the exudation extends over the whole extent of the mucous surface of the *colon*, which appears covered with black, grumous, carbonized-looking masses, even to the upper part. Ulceration is most frequently seen in the *sigmoid flexure*, destroying at once the exudation and the mucous

membrane, so as to expose the muscular tissue of the gut, which is red and irritable. An *appearance* of ulceration often extends in lines across the gut, so as to embrace its whole calibre in some parts. This is sometimes, however, only an appearance of ulceration, caused by the separation of the exudation when it is thick, exposing the highly vascular mucous surface below, which looks raw and ulcerated. When the gut is opened in the usual way after death, and extended on a flat surface, the change from the hitherto curved condition of the intestine is so great as to cause rupture or separation between masses of exudation, especially in places where it is thick, thus giving rise to the appearance noticed, and which has sometimes been described as ulceration. In long-continued chronic cases the rectum is generally studded over with punched-out looking ulcers with bloodless bases and thin anemic edges; and the melanotic deposit, already noticed, is here seen in the greatest abundance. Evidence of healed ulcers, with partially renewed mucous tissue covering them, are not uncommon in this locality, their place being indicated by the amount of black matter. The gland tissue, however, is not reproduced in the cicatrix substance.

Anatomy of the Morbid Tissues in Complex Cases of Dysentery.

—In the class of dysenteric cases which may be called *complex* there are a variety of lesions, the pathological significance of which as to extent, form, origin, and locality, renders the cases of dysentery in which they are found of a very complex kind. The morbid lesions which chiefly tend to render cases of dysentery complex, are,—(1.) Extension of the dysenteric process over the mucous membrane of the small intestine; (2.) Deposits and ulcerations in the glands of Peyer, as well as in the general tubular structure near the ileo-cæcal valve; (3.) Atrophy of the glandular parts of the mucous membrane of the alimentary canal; (4.) Secondary lesions of serous membranes; (5.) Secondary lesions of solid viscera in the *abdomen* and *thorax*; (6.) Secondary lesions due to the scorbutic, typhous, or tubercular states.

In some rapid and acute cases of *dysentery* (five out of twenty-eight cases, as observed by Dr. Baly) it has been noticed that the process by which the *dysenteric lesions* were developed in the large intestine extended beyond the ileo-cæcal valve, and brought about an action in the small intestine similar to that in the colon. As much as the lower two-thirds of the ileum have been involved

in this process, while the upper portion has been found intensely congested. In one case of *dysentery*, Dr. Cheyne says he found an exudation of lymph extending nearly over the whole of the jejunum. If the stomach participates in the disease, the mucous membrane may be merely diffusely inflamed, or of a red or violet colour, its surface granulated, and its texture broken by the slightest touch. More commonly, perhaps, the colour of the mucous membrane is natural, but on its surface a number of ecchymosed spots, or small ulcers, are seen, with edges so sharp, clean, and perpendicular, that they appear as if made with a punch. In other cases the tubular glands, as well as the solitary and aggregate glands of Peyer, have shown various stages of morbid action. The absorbent mesenteric glands are rarely affected (BALY); but except in cases of secondary hepatic abscess, they were found enlarged and inflamed in all cases of Indian dysentery (PARKES).

By far the most common condition, however, in chronic cases of *dysentery* especially, is that which is due to atrophy of the mucous membrane. As an atrophic change, it may be ascribed to the general wasting (marasmic) processes which take place to a great extent throughout the system in cases of *chronic dysentery*. In this complex state the mucous membrane of the *small intestine* appears pale, thin, and worn—a condition which pervades the greater part of the alimentary canal, and which is especially made manifest in the living as well as in the dead by the condition of the mucous membrane of the mouth. On turning down the lips the mucous glands are seen distinctly projecting through the thin pale labial and buccal mucous membrane. When such cases are examined after death the structure of the solitary glands, and of Peyer's patches, are found to be degenerated and wasted; no gland cells are to be seen, and their place is supplied by fibroid tissue, with some vascular injection round the reticulated spaces. In other instances a deposit of black pigment surrounds the locality of the glands, which indicates the long-continued process of vascular action previous to their atrophy. Associated with this general atrophic state, some gland patches may be observed in an apparently opposite state—that is, distended and sometimes engorged; but on examination their contents appear to be undergoing a molecular, melanotic, and generally fatty degeneration, probably preparatory to complete evacuation and destruction of the gland element. These two apparently opposite conditions

co-existing in the same cases, appear to indicate that the one condition is but the antecedent of the other; and that the atrophy and degeneration is the last result of a series of morbid processes commencing in the engorged gland cavities.

In parts of the mucous tissue which exhibited the opposite conditions of extreme hypertrophy and extreme atrophy, the specific gravity of the former indicated 1.046, while the thin and wasted part of the intestine indicated a specific gravity of 1.036 to 1.030.

There is now abundance of evidence to show that, in some endemic cases, or in epidemics of *dysentery* in some places, there is a tendency to the secondary engagements of organs or parts, during or subsequent to the development of the dysenteric process. Some look upon these secondary processes in relation to the dysentery as in the relation of effect following a cause; or that there is an immediate and direct connection between the primary dysenteric process and the secondary lesion. Such a relationship has not been shown to exist in all cases; and it is more probable that the *dysenteric* process, when it operates on the system during a protracted period, predisposes, as many other morbid states do, to the development of secondary local lesions in distant parts.

The arachnoid, the pleuræ, the pericardium, and the peritoneum have each and all of them in some instances been the seat of opacities or of fluid exudations in dysenteric cases.

Of morbid states of the solid viscera, associated with dysentery, by far the most frequent complication is that with the *kidney* and the *liver*. With regard to the kidneys, their relation to the bowel affection is as yet obscure; but in mild cases, proceeding to a favourable termination, there is no albumen and no casts in the urine. When, on the other hand, the dysentery is severe, it continues some time before exudation appears in the urine, and then its occurrence is preceded and attended by putridity of the copious stools, by *status nervosus*, collapse, and paralytic phenomena. If the renal affection occurs early, so much more severe is the case, and death usually speedily ensues. The kidneys, after death, are seen to be highly congested, the tubes loaded with exudation, cells, and detritus. (Zimmerman, *Syd. Society Year-Book for 1861.*)

The association of hepatic disease with *dysentery* would seem

to be most frequent in the climate of the East Indies, and in such climates as have a similar influence (MARTIN). In the Bombay army, out of thirty fatal cases of *dysentery*, twelve were attended with hepatic abscess (MOREHEAD). Dr. Macpherson, Sir James Macgrigor, Dr. Parkes, and Mr. Henry Marshall, give similar statistical results of their experience at Calcutta, Moulmein, and Ceylon. The French surgeons in the province of Oran, in Algeria, state that hepatitis and consequent abscess were frequently coincident with dysentery. Dr. Parkes observes, that if the functional morbid state of the liver is to be judged of by chemical analysis of the secretion of that viscus, the liver is found to be diseased, more or less, in every case of dysentery. The tendency to hepatic complication was found in Algeria to increase with age, and with the length of service in that country. It was also observed by Sir Ranald Martin that certain portions of the large intestine, namely, the cœcum and the rectum, appeared to be most affected when the complication in dysentery has been of the hepatic nature. It appears, however, that hepatic abscess is but rarely associated with dysentery in natives of those warm climates; and amongst British subjects in their native climate it seems equally rare. In the Millbank Prison, "out of many hundred cases, not one has been complicated with hepatic abscess." It does not appear, however, that the influence of the climate of the East only on Europeans tends to the hepatic complication, for "in the Peninsular army, under the Duke of Wellington, the spleen, the liver, and the mesentery were generally found diseased in cases of dysentery; so were these viscera in the epidemic dysentery of Ireland" (MARTIN). In the dysentery of the allied armies in the hospitals of the East during the late Russian war, hepatic abscess was of rare occurrence. Dr. Budd attempts to explain how hepatic abscess is a consequence of dysentery through the vitiation of the portal blood from the morbid intestines. But the ulceration must be of a peculiar kind; for typhoid ulcers *do not* tend to hepatic abscess, nor do tubercular ulcerations. Therefore there must be something specific to do this.

Regarding hepatic complication in dysentery, the following conclusions are given by Sir Ranald Martin in his excellent account of the acute dysentery of Bengal:—

1. That dysentery, in a great number of cases, commences and runs its course uncomplicated by hepatic disease.

2. That hepatic disease *may*, in some cases, be the predisposing or exciting cause of *dysentery*.

3. That a large majority of the fatal cases of *dysentery* are complicated with hepatic abscess.

4. That in a much larger majority of these cases ulceration of the intestine is the primary disease and the source of the hepatic abscess.

Nevertheless, although the connection between abscess of the liver and dysentery, as a clinical fact, is indisputable, the exact relationship and pathological significance of the morbid state are still open questions.

The occurrence of hepatic abscess has been viewed as a result of phlebitis; but Dr. Parkes, after the most careful observation of such cases, says that he has never found the slightest trace of inflammation in the small veins of the intestine, while no direct proof has been advanced of the mediation of the portal blood in the process; and in conclusion, writes Dr. Hensch, "I believe we must give the preference to that view which regards the two diseased processes, dysentery and abscess of the liver, as without mutual relation, but as running their course together dependent upon one and the same cause; in favour of which view is the circumstance, that in hot climates abscess of the liver very frequently occurs associated with remittent fevers, or consecutive to them, without dissection exhibiting any ulceration of the mucous membrane of the intestine." (*Brit. and For. Med.-Chir. Review*, July, 1854.) The comparative frequency of the occurrence of hepatic abscesses may be seen from the following statement:—

In *Calcutta* General Hospital they occur at the rate of 16·8 per cent. (MACPHERSON); in the Medical College Hospital at the rate of 25·9 per cent.; in *Bombay* General Hospital at the rate of 40 per cent. (MOREHEAD); and in *Madras* Presidency at the rate of 50·97 (ANNESLEY), 19·35 (PARKES), 17·9 (INNES at Secunderabad).

Too much attention and importance seem to have been put upon abscess of the liver *per se*, irrespective of other obviously morbid conditions—*e. g.*, impaired function, congestion, enlargement. To regard secondary hepatic abscess as due to absorption of pus or other morbid matter from ulcerating mucous membrane, or to a true phlebitis, is to take too narrow a view of dysentery and liver diseases; for, if we are to judge by the

condition of the bile alone, the liver is diseased (in function, at least,) in every case of dysentery (PARKES). The contrast of the results given in the above table, with the result of the cases seen in colder climates, is indeed remarkable. Baly's experience yielded him no abscesses of the liver. Finger, of Prague, dissected 231 cases of dysentery between 1846 and 1848, and found no abscess of the liver. Broussais records seventeen dissections of dysentery in the camp during 1805 and 1806, and no abscesses of the liver. Rokitsansky has never found the liver visibly diseased in cases of dysentery; and in China, where dysentery, as a rule, is very fatal to Europeans, the rarity of hepatic abscess is said to have been remarkable. (Dr. Wilson in *Records of Hospital Ship "Minden."*)

On the whole, it will be seen that the association of dysentery with hepatic abscess is not equally frequent in all countries, nor in all epidemics. It seems to have been most frequent in the climate of the East Indies, and in the Bombay army especially (MOREHEAD, PARKES). There are some epidemics in Europe in which the hepatic lesion has been observed; *e. g.*, in Dublin, 1818, it was observed in four out of thirty cases (CHEYNE). It would, therefore, appear that the *poison* which causes dysentery has at some times and places the power of establishing hepatic complication so severe as to lead to abscess; at other times and places it seems to be less virulent.

The spleen and pancreas are sometimes also found diseased; and Mr. Twining notices the former as one of the most fatal complications of dysentery in the East Indies. These viscera are found either enlarged and softened, or enlarged and indurated, the spleen being sometimes the seat of abscess.

Of thoracic viscera, the lungs have sometimes exhibited a great tendency to secondary morbid processes in dysenteric cases. This was especially the case in the dysentery of the allied armies during the late Russian war, where otherwise pulmonic lesions were rare.

The pulmonic lesions associated with the dysenteric process were as follows:—(1.) More or less extensive lesion of the bronchial membrane, the finer ramifications of the tubes being filled with frothy mucus and pus-like exudation, and associated with extensive vesicular bronchitis: there were well-marked spots of lobular pneumonia. (2.) Exudations into the pulmonary parenchyma, chiefly in the form of isolated deposits of consider-

able density, disseminated through the substance of the lungs. These masses passed into a purulent condition, and microscopically they were composed of broken up cells, granular matter, and pus elements.

The last class of conditions which render cases of dysentery complex is the alliance of other disease-processes with dysentery. Such cases are generally of a very protracted duration; and the associated morbid lesions are not only complex from the number of morbid processes developed and the organs attacked, but they are complex from the variety of the kind, degree, and extent of the co-existent affections. Many disease-processes may be observed to co-exist in one patient; and such multiplicity of disease-processes tends greatly to multiply the number of the anatomical local lesions, and thereby still more to complicate the case.

Dysentery, as Martin remarks, "is found to complicate readily in all climates with the prevailing fevers." Within the tropics it is frequently associated with *remittent* and *intermittent fevers*; in the geographical region of *typhus fevers* it is a most frequent complication, under various circumstances, and becomes contagious; and lastly, it is also occasionally complicated with *scurvy*. When dysentery follows upon, or is associated with, intermittent fever, the spleen will frequently become enlarged, indicated in the outset by general anæmia, or splenic cachexia, with a low asthenic type of dysentery.

The scorbutic complication is developed in *dysentery* when the supply of food is unwholesome, or when it consists in whole or in the greater part of salted meat. Sir Gilbert Blane asserts that the complication has been known to arise among prisoners of war, living entirely on fresh diet, and solely imputable, therefore, to confinement in bad air, a dull uniformity of life, depression of spirits, and the indolent habits of captivity.

"The most terrible instance of suffering from this cause," writes Sir Ranald Martin, "was that of the European portion of the force employed in Ava during the first Burmese war, where they were for six and a-half months fed on salt rations, and where forty-eight *per cent.* perished within ten months, principally by dysentery with the scorbutic state." Such disasters have since been equalled, if not surpassed, by the sufferings of our troops in the camp before Sebastopol during the winters of 1854-55, under

the influence of exposure, fatigue, and continued rations of salt meat and green coffee.

There is still another light in which the pathology of this disease requires to be studied, namely, in the

Types and Forms of Dysentery.—These have been very variously described as the (1.) *purely inflammatory, acute, hyper-acute, or asthenic* form. In this form, while the phenomena indicate acute and severe inflammatory action, there is no tendency to the great depression of the nervous, circulatory, and muscular function, which gives a marked character to some of the other types of the disease, such as (2.) the *asthenic* forms. In the *asthenic* forms, besides the depression of the functions just noticed, there is much greater tendency in these forms to spread by infection, or under an epidemic influence. These *asthenic* forms are sometimes described as *adynamic, typhoid, malignant, bilious, intermittent, or remittent*, according as certain phenomena prevail characteristic of these states.

Symptoms of Dysentery.—An ordinary attack commonly commences with *diarrhœa*; but in twelve or twenty-four hours disagreeable feelings begin to attend the frequent loose discharges from the bowels. These are irregular pains, commonly called “gripes,” along the course of the large intestine, and sometimes described as “shooting,” or “cutting.” Technically, such symptoms are known as *tormina*. They are momentarily relieved by discharges from the bowels. But after a short time a sense of heat ascends from the rectum, and pain extends to the epigastrium, till the whole abdomen is painful. There is a frequently returning inclination to go to stool; the griping and straining continue without the patient being able to pass anything more than a little bloody mucus. These symptoms are generally aggravated during the night and early morning, and they leave behind them the exhausting sensation that there has always remained in the bowel something which has yet to be discharged. This feeling is technically called *tenesmus*, and ultimately becomes the most striking feature in the case. The acute pain in the abdomen, although it may extend to the iliac regions or flanks, generally concentrates itself at last about the rectum.

The discharges from the bowels are at first scanty, consisting of mucus and blood, or bloody slime, as it is sometimes called. As the disease progresses the evacuations become more copious,

tinged with bile, and carrying off shreds of the exudation thrown out on the mucous surface of the intestine. Hardened balls of faeces, called *scybalæ*, are also sometimes discharged; these, however, are seldom seen in tropical dysentery, and if much feculent matter pass there is always considerable relief. When the disease is fully established the discharges exhale an odour different from the smell of faeces, and which is almost peculiar to dysentery, and very offensive. It is important to observe the character of the discharges, and especially as to the relative amount of blood mucus and shreds of exuviae. If the disease advances, besides the constitutional symptoms becoming aggravated, more blood and mucus appear in the discharges from the intestines, together with shreds or large sloughs of exudation, which are often described as pieces of mucous membrane. In very acute cases, going on rapidly to an unfavourable termination, a great change often takes place in the nature of the stools, which become suddenly copious, serous, of a reddish-brown colour, with black spots, attended with a putrid, offensive odour, which pervades the whole house. In the acute dysentery of Lower Bengal the patient is not unfrequently carried off by copious discharges of blood (W. C. MACLEAN). The shreds, however, are not mucous membrane, but, like the dysmenorrhoeal membrane, which forms on the internal surface of the uterus, the dysenteric slough varies in consistence, thickness, and strength. It may be washed perfectly white in water, and its minute histology shows no character of a mucous membrane. The hardened balls of faeces are much more rarely seen than they have been described to be. When the skin is dry and of a pungent heat, the tongue furred, and the thirst urgent, the urine scanty and high-coloured, and the pulse increasing in frequency—these are symptoms of increasing danger in dysentery. Throughout the disease there is febrile distress, the nights are passed without sleep, or when it is obtained, it is in short periods, dreamy and disturbed; and when the patient awakes he is unrefreshed, and his spirits low and desponding. In the majority of cases the disease takes a favourable turn between the sixth and tenth days, the symptoms are then mitigated, the pain ceases, the number of stools diminish, and the flow of urine is restored. On the contrary, if it terminates fatally in this stage, hiccough, vomiting, a small and rapid pulse, and pale sharp features, denote the approach of death. The intellect, however, is perfect, and the

patient, often deploring the fate which he sees inevitably to await him, dies after a short agony. If the disease proves fatal in the chronic form, the patient generally becomes rapidly altered and prostrated by his sufferings, is strikingly emaciated, and often earnestly prays to be relieved from a life disgusting to himself and entirely despaired of by others. Death begins at the heart. On the contrary, the patient in a few rare instances recovers, the local symptoms gradually yield, till his health and strength are ultimately restored, in a moderate degree. Convalescence is slow, rarely complete, and there is perhaps no disease which makes so persistent and pernicious an impression on the human constitution as dysentery.

Causes and Modes of Propagation.—It may be stated, as a general proposition, that there is no country where paludal fever exists that dysentery is not an endemic and prevailing disease. In the East and West Indies, in China, the Ionian Islands, Gibraltar, Malta, the Canadas, Holland, the coasts of Africa, as well as in many different parts of France, of the Peninsula, of the continent of America, and of the Eastern parts of Great Britain, the prevalence of intermittent or remittent fevers and of dysentery is notorious.

This connection is so intimate that a given number of persons being exposed to the action of paludal miasmata—as, for example, a boat's crew sent ashore in a tropical climate—the probabilities are, that of the men returning on board, part will be seized with dysentery and part with remittent fever.

Paludal fever and dysentery, moreover, are not only conjoined in locality, but they often co-exist, precede, or follow each other in the same individual, so that the fever frequently ends in dysentery, and the dysentery in remittent fever. This proof of the common nature of these diseases is corroborated by every writer of any celebrity, and more especially by those who have detailed the diseases of our armies. But dysentery also prevails where there is no other evidence of the presence of malaria. Nevertheless, the evidence in favour of malaria being the common, though probably not the sole cause of dysentery, appears to be much the stronger. It seems also determined that dysentery prevails generally in the inverse ratio of the intensity of paludal fever. In Jamaica, for example, when the white troops suffered in the large proportion of 91 *per cent.* annually from paludal

fevers, the cases of dysentery were to those of fever as one to nine: while in the Madras presidency, when the troops suffered from fever in the much less ratio of only 30 $\frac{1}{10}$ *per cent.* annually, the cases of dysentery were to those of fever as forty-seven of the former to thirty of the latter. It appears that dysentery is less common in the hotter than in the colder months, or arises under circumstances less favourable to vegetable decomposition. Thus in India and China it is from the middle of November to the latter end of February, or when remittent fever changes into intermittent, that dysentery greatly prevails.

Our knowledge of the predisposing causes is derived from what principally occurs in the military and naval service; and from the sufferings of the troops we learn that exposure to the night air, to wet, or to fatigue, together with the intemperance and often improper diet incident to the life of a soldier, especially on active service in the field, have at all times been found to be powerful predisposing causes to dysentery.

The effects of *salt* diet in the production of dysentery being less known than the other predisposing causes, it may be as well to state, that by an experience of twenty years in the West Indies, it has been determined that in the Windward and Leeward Command, when the rations issued to the troops consisted of salt provisions five days in the week, the mortality from diseases of the stomach and bowels among the officers was as two to four *per cent.*, while that among the soldiers is as 20·7, or a tenfold ratio. On the contrary, in Jamaica, when salt provisions were issued to the troops only two days in the week, the mortality from the same diseases approximated so nearly between these two ranks as to be almost an equality. And corresponding facts to these have been observed in Gibraltar, on the coast of Africa, and at St. Helena. The Sierra Leone commissioners on the western coast of Africa, who investigated this subject on the spot, were of opinion that the large proportion of salt rations mainly contributed to the sickness and mortality from diseases of the stomach and bowels in the form of dysentery and diarrhoea; and the following statement, given by Sir Alexander Tulloch in his Statistical Reports (page 11) on the sanitary condition of the troops in the West Command, shows the marked reduction which took place in the deaths from this class of diseases subsequent to the introduction

of fresh meat diet; the mortality being reduced to a *tenth* part of its former ratio:—

PREVIOUS TO ALTERATIONS IN RATIONS.						SUBSEQUENT TO ALTERATIONS IN RATIONS.					
Year.	Mean Strength.	Dysentery and Diarrhoea chiefly.		Ratio per 1000 of Mean Strength.		Year.	Mean Strength.	Dysentery and Diarrhoea chiefly.		Ratio per 1000 of Mean Strength.	
		Admitted.	Died.	Admitted.	Died.			Admitted.	Died.	Admitted.	Died.
1825	571	235	32	411	56	1828	232	139	1	600	
1826	471	256	26	543	56	1829	114	50	—	439	
1827	345	209	13	606	38	1830	42	22	1	524	5 $\frac{1}{5}$
						to 1836					
Total, ..	1387	700	71	Average. 505	Aver. 51	Total,	388	211	2	Average. 543	5 $\frac{1}{5}$

In the navy the same effects of ill-regulated diet have been observed, and the good effects of a change. "In 1797," says Dr. Wilson, "the victualling (of the navy) was changed, greatly improved, and consequently immediate to the change the health of the seamen improved strikingly. *Scurvy*, *typhoid fever*, *dysentery*, and *ulcer*, which, up to the period of the change, had produced great havoc, became comparatively rare in occurrence and light in impression," and, it may now be added, are hardly known except by name.*

The last appearance of dysentery in London was apparently owing to an insufficient diet, and occurred at the Penitentiary, Millbank, shortly after its completion. This prison is built on a marsh below the level of the Thames at high-water, the river being banked out by a narrow causeway. As long as the prisoners were allowed a full and ample diet they appear to have resisted the action of the paludal poison, and to have enjoyed good health. No sooner, however, was the quantity and quality of their dietary lowered than dysentery of a very fatal character broke out, and made it necessary to clear that establishment for a

* As Dr. Christison justly observes, the salt meat of military and naval rations is not the same as the salt meat of civil life. The former is highly salted, in order to keep for two or more years in every climate. Its nutritive value is thus greatly overrated, and its nutritive constituents are still further diminished by the process of washing out in water before it can be eaten. Thus, besides the irritant effects of the salt diet in producing dysentery, another element exists as a cause of disease—namely, the insufficient nutrition which the salt ration diet is able to impart.

time of all its inmates. There are few facts to enable us to determine the proportions in which the different ages suffer from dysentery, but the returns of the troops from the Mauritius show that the mortality from this disease falls principally on soldiers advanced in life (TULLOCH).

FORCES IN THE MAURITIUS.	Age.			
	18 to 24.	25 to 32.	33 to 40.	40 to 50.
Aggregate strength of seven years,.....	3892	5361	1215	300
Died of Dysentery,.....	26	63	24	8
Ratio per 1000 of mean strength,.....	6·7	11·8	19·7	36·6

Besides unwholesome solid food, water of an impure kind and from an impure source favours the development of dysentery. Drained from swamps and used for drinking and cooking purposes, as it was on the Chinese coasts, it exerted a marked injurious influence both in exciting and in maintaining the disease. In connection with impure water, the reader is requested to refer to what is said afterwards under the head of Parasitic diseases; and especially under "*distoma hæmatobium*."

Many other causes bring about the disease, especially amongst soldiers in active service—namely, long marches in hot weather, bivouacking at night in the open air (often extremely cold both absolutely and relatively to the day), want of sufficient clothes and bedding, may be mentioned as the chief.

It does not seem to be so clearly understood as it ought to be, that dysentery is contagious. Being a frequent complication or concomitant of contagious fevers, it has been believed to inherit similar contagious properties. In the severe form of dysentery, for which the old Infantry Barracks of Secunderabad in the Deccan have long been notorious, it has been observed that men, labouring under other diseases, who happened to be exposed to the putrid effluvia of the excretions of dysenteric patients, were often severely affected by the disease (W. C. MACLEAN). There is, therefore, good reason to believe that the exuviae of dysenteric patients, as passed by stool, may, like those of typhoid fever, propagate the disease; and the observations of Budd and Goodeve give support to this view.

Prognosis.—The prognosis in dysentery depends much on the country in which the disease occurs; but in hot climates it is

calculated that the deaths vary from one in nine to one in twenty; and on actual service the chances of recovery are much diminished. In all returns, however, the total deaths recorded give a faint idea and inaccurate representation of the real mortality resulting from dysentery. If it were possible to trace out the men who were invalided from the army and navy services from the effects of this disease, it would be found that the mortality is very much greater than is represented by tabular returns. It is a malady which, once fairly engrafted on the system, never leaves it till life itself becomes extinct (BRYSON, and others). It is sometimes also insidious in its mode of attack and progress; and there is such a desire, on the part of soldiers especially, to avoid the restraints of hospitals, that the disease is sometimes beyond the power of medicine before coming under treatment, especially in tropical commands (TULLOCH). There may be diseases of a more rapidly fatal character, but there are few which entail so great an amount of suffering. When once the disease has passed into the chronic form, it slowly, but not the less surely, continues, by a most loathsome process, to exhaust the vital energies, until death relieves the patient of an existence rendered almost intolerable by pain, debility, and the offensive nature of the discharges (BRYSON).

Diagnosis.—It is difficult, perhaps impossible, in the first stage, to distinguish dysentery from diarrhoea; but the blood, the number of the stools, and small quantity of faecal matter passed, will, in times when dysentery is prevalent, indicate the true nature of the disease.

Treatment.—Every conceivable mode of treatment has been tried in this disease. The success has been various, more especially according as the patient has been treated while still subjected to, or in the midst of, causes which tend to foster the disease, or when he has been removed to another climate at an early period. After what has been written regarding the nature and the causes of dysentery, it is the obvious duty of the physician to direct his attention, in the first instance, to the *prevention* of the disease. Next, he ought to insure the means of detecting the disease early, for time is of the greatest importance in its cure and prognosis. “He who would treat this disease with success,” writes Sir Ranald Martin, “while he shuns exclusive means, must assign to each remedy its proper value.

Blood-letting, sudorifics, and purgatives, constitute the most universal remedies, and in simple uncomplicated dysenteries they will prove all-sufficient. But when the abdomen is tumid, and there is pain in the liver, or in any other region, while the nature of the discharges indicates advancing inflammation, calomel, conjoined with sudorifics, and repeated to meet the occasion, will powerfully aid the curative effect through its influence on the depurative functions—on the circulation, by unloading, jointly with purgatives, the gorged vessels of the abdominal organs—on the blood and on secretions generally—and on the very sudorific function which we wish to excite. While calomel is a most powerful agent when used judiciously, as an aid to blood-letting, pushing it to the extent of ptyalism is by no means to be recommended; nor should mercury in any shape be used in adynamic forms of the disease, in the splenic cachexia, nor in states of anæmia, for in all these conditions of the system its actions are most injurious.”

The favourable and almost specific actions of *mercury* in many of the secondary actions of the paludal poison make an investigation into the effects of this substance in the cure of dysentery a matter of much interest, especially as it has been extensively used, and in many cases with unquestionable benefit. It is to be regretted, however, that much difference of opinion exists as to the circumstances under which it should be administered. Some prescribe it in the acute stage, others restrict its use to the chronic stage; some give it in every stage, while others think it ought to be withdrawn when the tormina is relieved. Some give it in scruple doses, others more moderately, but push it till the mouth is affected, while others give it in small doses only. In the midst of all this confusion Sir James Macgrigor believed this medicine to be applicable only to the dysentery of particular countries, and that the dysentery of India and of Europe are different diseases,—dysentery being readily cured by calomel in India, while in the Peninsular war that medicine was only decidedly useful in dysentery complicated with liver complaints. If given under other circumstances, or in the early stage, and before venesection, or in the more advanced stage, particularly when there was hectic, with extensive erosion or ulceration of the intestine, it was invariably found to aggravate the symptoms and to hasten the fatal termination. *Ipecacuanha* was formerly, and still is,

much in vogue as a specific remedy in the treatment of dysentery; but although highly useful in some conditions, it has no pretensions to being a specific. Neither *bleeding*, *calomel*, nor *ippecacuanha* are antidotes to this disease, and consequently there is no exclusive plan of treatment applicable in all cases. Admitting, therefore, the necessity of occasionally employing general and local bleeding, and also calomel, in cases of hepatic complications, we have beyond this only the general principles to guide us of allaying irritation and of controlling, if possible, the diarrhoea; and the best general rules that we possess are those recommended by Sir James Macgrigor to be adopted in the army (acknowledged by him to be derived from Dr. Somers); those given by Sir Ranald Martin, already detailed; and those by Professor Maclean, about to be noticed.

"We commenced," says Sir James Macgrigor, "by copious venesection, and immediately afterwards gave twelve grains of compound ippecacuanha powder every hour, which was repeated three times, with plenty of barley water, and profuse sweating was encouraged for six or eight hours. A pill of three grains of calomel and one of opium was administered every second night, and in the intervening day two drachms of sulphate of magnesia dissolved in a quart of light broth. The venesection was repeated, while the strength and pulse permitted it, until the stools were free, or nearly free, from blood. Dover's powder as a sudorific was always given after the blood-letting.

"In cases where the pains were excruciating, and attended with tenesmus, the warm bath gave instantaneous relief. This plan being steadily persevered in for a few days, the inflammatory diathesis of the intestinal canal, which had excited symptomatic fever throughout the general system, was found gradually to be relieved, and paved the way for returning health. In this stage gentle tonics, with light nourishing diet cautiously taken, and at first given in moderate proportions, were administered with the happiest effects.

"The disease was not unfrequently cut short by this method. If, however, the disease became chronic, a different mode of treatment was pursued, and not unsuccessfully, if the disease had not been of long duration, the intestinal canal not much disorganized, or not complicated with other diseases."

"The first indication in this chronic state was to relieve the

tenesmus and procure easy stools, and with this view *ipecacuanha* was given, sometimes with calomel, sometimes without it. The neutral salts were given, or castor oil, jalap, and various other medicines of the same class. The second indication was to relieve the number of the stools, and to restore tone to the alimentary canal. With this view Dover's powder, the compound powder of chalk with opium, astringents, and demulcents, with aromatics, were given, occasionally interspersing laxatives, and obviating particular symptoms as they occurred. Lastly, an infusion of bitters was given to restore tone to the relaxed intestine."

In addition to these remedies, Sir James Macgrigor states that the balsam of copaiba, an infusion of calumba, hæmatoxylon, kino, and catechu, assisted by opium occasionally, gave much relief, and also the administration of a variety of enemata, and especially one of a strong solution of superacetate of lead; while in cases of liver affection, he adds "that friction of the abdomen with mercurial ointment gave the least irritation, and at the same time produced less debility."

Such is a statement of the practice pursued in dysentery during the Peninsular war, on a scale whose magnitude has seldom been surpassed even in modern times. If, however, we look to the returns, we find it highly probable that not more than two out of three of those attacked ultimately recovered.

In general the dysenteric patient is not admitted into the hospitals of our large towns until the disease has passed into the second stage, and there is no class of disease which then offers so few chances of recovery. On the Continent the neutral salts and mild purgative medicines are highly spoken of; but it is difficult to understand how these substances, having no specific power over the disease, can be beneficial in a highly ulcerated state of the intestine. Of all the purgatives, however, two ounces of an infusion of *ipecacuanha* (in the proportion of one drachm to a pound of boiling water), combined with five to ten drops of the *tincture of opium*, and given every six or eight hours, appears to be the best; but the disease, though mitigated, is seldom cured by these means. Vegetable tonics, containing *tannin*, as *kino*, *hæmatoxylon*, or *catechu*, however prepared or combined, give temporary relief, but are ultimately inefficient. When the disease has fairly gained the ascendant it does not appear that one remedy is better than another. Dr. Bryson writes that he has seen all

the astringents, both mineral and vegetable, mercury, both internally and externally, with many other medicines, tried without any benefit; but there were some means which were useful in relieving the more urgent and distressing symptoms, and, as it were, in smoothing the path to the grave. Amongst these he mentions a *well-regulated farinaceous diet*, *opium suppositories*, *anodynes*, *astringent injections*, minute doses of *calomel* in combination with *opium*, *cascarilla*, *resinous astringents*, and the application of *leeches to the rectum* when tenesmus was distressing, or over the course of the colon when there was deep-seated pain. An injection of warm starch (two ounces), with laudanum in it, will often give relief.

The value of a change of climate, as a curative measure, is forcibly illustrated by Dr. Bryson. He says that the crews of vessels improved in health almost immediately after quitting the station where dysentery prevailed.*

* My friend and colleague, Professor Maclean, writes me the following note on the treatment of dysentery, the result of his extensive experience in India and China:—"The first thing to bear in mind in the treatment of tropical dysentery is, that the appearance of strength in the patient, given by the acuteness of the symptoms, is delusive. Under the use of strong antiphlogistic treatment the strength of the patient is apt to fail suddenly, and this is often the case even when the treatment has been more conservative in its character. It was once the custom in India to bleed freely in this disease, either by a general bleeding or by the repeated application of leeches; but the most judicious and successful practitioners in India rarely bleed now, even in the most sthenic forms of the disease, and confine the use of leeches within the narrowest limits.

"**Mercury.**—It is certain, too, that mercury is yearly less and less used in India than it was, and there is much evidence to show that a corresponding reduction in the mortality of the disease has been the result. The objections to its use are numerous,—it entails great suffering on the patient, if pushed to ptyalism, aggravating his miseries, and too often permanently injuring his constitution; it has no specific action on the disease, and its cholagogue effects can be attained by remedies which are not open to such objections as can be brought against mercury. (With regard to its cholagogue effects, grave doubts are thrown by the experiments of Dr. George Scott, referred to at the footnote of page 157, by the author.) In sloughing dysentery it is followed by the worst results; and the observations of clinical observers in India have shown that individuals under the influence of mercury are not only not exempt from attacks of the disease, but are peculiarly prone to be affected by it. This is the case in a very marked degree in Asiatics (MOREHEAD and MACLEAN).

"**Ipecacuanha.**—This remedy has long been used in South America in the cure of dysentery, whence, indeed, it came. It was much used in India until the mercurial notions of James Johnson prevailed. It was again used by Dr. Twining, of Bengal, by whom it was strongly recommended, and also by Dr. Mortimer, of Madras. Twining combined it with blue pill and gentian, and used it chiefly in small and

DIARRHŒA—*Diarrhœa*.

Definition.—*A frequent discharge of loose or fluid alvine evacuations, without tormina or tenesmus.*

Pathology.—This affection is rather a consequence or a symptom of certain pathological states than of itself a disease; yet, there are many agents, both of a moral and physical nature, that act upon the human body; and, as there are also many known morbid poisons which bring about this state, it merits some notice in the class of diseases now under consideration. It is a morbid action of function rather than any disease of structure, being unassociated with any definite specific lesion of vital parts. It may be regarded generally as the immediate result of unwholesome diet, excess in food or drink, cold, wet, fatigue and exposure and various functional derangements of the biliary and gastric intestinal apparatus.

Symptoms and Forms of Diarrhœa.—Nosologists have generally divided the disease into varieties founded on the different states of the discharges; but as these do not depend upon definite pathological states, the classification is of little use. Nevertheless

oft-repeated doses. In South America the practice has always been to administer an infusion of the bruised root,—3ij. being infused over night in 3iv. of water, and given early in the morning. In Peru it is given in doses of 3ss. to 3i. of the powdered root in a little syrup and water. This practice of giving ipecacuanha in large doses has lately been revived in India with encouraging success, and, I believe, the greatest number of cures. It appears to act on the portal capillaries and on those of the mucous membrane of the bowels, and to determine powerful action to the skin. It is usually given in doses of half a drachm or a drachm, either in pill or bolus, or suspended in mucilage, according to the fancy of the patient. It is advisable to give an opiate half an hour before, and to withhold all drink for some hours. Unless there be hepatic complication, it seldom happens that much vomiting is caused by these large doses; on the contrary, they are often tolerated when smaller doses are rejected. The dose should be repeated in about six hours. In no disease is early treatment more necessary than in dysentery, and I believe that if conducted as above, except in the malignant and "putrid" forms, we may look for good results in a large proportion of cases. Turpentine epithems and fomentations should be diligently used, and the patient's strength should be supported by nourishment of a bland kind, suited, in degrees of nutritive value, to the stage of the disease.

"In the scorbutic form we have a valuable remedy in the *Bael fruit*, when procurable. This fruit contains a large quantity of *tannin*, with vegetable mucus, a bitter principle, and a vegetable acid. It is much used in Bengal; and in the scorbutic form I have seen it successful when all other measures have failed. (See note on Bael fruit, by Dr. Grant, in *Indian Annals*.)"

the state of the discharges furnishes important indications in the treatment of the disease. The most common appearances are due to the predominance of fluid feculent matter, or to bile, mucus, serum, chyle, or where undigested masses of food pass unchanged, giving rise to what is termed a "lientery." But the discharges are more often of a mixed kind, made up of several of those states.

The idiopathic forms of diarrhœa which require notice are,—(1.) *Diarrhœa of irritation*; (2.) *Congestive or inflammatory diarrhœa*; (3.) *Diarrhœa with the discharge of unaltered ingesta (lientery)*.

1. *Diarrhœa of Irritation.*

This form comprises most of the cases denominated *feculent* by authors. It is induced by stimulating or irritating substances received into the stomach, excesses in eating or drinking, or even by a small quantity of unwholesome food, or what constitutionally disagrees with the patient. In infants it is often brought on by unwholesome conditions of the milk, such as the persistence of colostrum in it. Nausea, with severe griping pains before each evacuation, a foul, loaded tongue, copious feculent stools, watery, mucous, or bilious, and becoming frothy, are the phenomena of this form of diarrhœa.

2. *Diarrhœa from Increased Vascular Action.*

This variety is caused by whatever induces a greater flow of blood to the intestinal mucous surface, and at the same time lessens or obstructs the cutaneous elimination of fluids; the application of cold to the cutaneous or pulmonary mucous surfaces, or to both at once; cold acid drinks, or ices taken when the body is overheated; suppression of perspiration or of accustomed discharges; checked menstruation or lochial discharge.

The evacuations are watery or serous, with mixed feculent matter, and exhibit every shade, from a dark brown, greenish-brown, to a pale greyish or whitish colour; and they contain, in some cases, pieces of thick, gelatinous mucus, or thin, glairy, and stringy mucus. In other instances whitish, albuminous flocculi are abundant in the stools; and in a few instances large membranous or albuminous shreds or flakes present a mould of the internal surface of the gut.

In addition to the symptoms noticed in the former variety,

there is, in this form of diarrhœa, a dry, harsh skin, with increased temperature of the trunk, a flatulent state of the bowels, a small, frequent, constricted, but soft pulse, a furred or loaded tongue towards its root, with red edges and point, and scanty, high-coloured urine. In infants this variety is known as the "watery gripes," and often precedes fatal exhaustion in them.

3. *Diarrhœa, with the Discharges of Unaltered Ingesta.*

This is essentially an atonic form of diarrhœa, and very different from the last variety. It corresponds to the "*diarrhœa lienterica*" of the older authors. The most marked and characteristic phenomena which attend the disease are due to the almost total suspension of the digestive, assimilative, and absorbent functions; the *egesta* often differing but little in appearance from the *ingesta*. Such a form of diarrhœa occurs more frequently in children before the period of the second dentition, than at later periods. It is frequently the consequence of previous inflammatory irritation of the alimentary mucous surface and disease of the mesenteric glands. It seems as if, in this variety, the stomach had lost its tone or vital energy, as well as the mucous membrane of the alimentary canal; and it no doubt results, in the first instance, from indigestion. This was a frequent form of diarrhœa amongst the soldiers in the Crimea, as observed by Dr. Lyons; and the soldiers themselves observed it, and were in the habit of saying, "it was of no use eating, as our food passes through us in the same state as it goes in." The appetite is usually voracious; and when this form of diarrhœa continues long, the debility becomes extreme; and when death takes place, it is from stupor and exhaustion.

In a practical point of view, these are the principal varieties of idiopathic diarrhœa which require to be distinguished; and the diagnosis of the form of diarrhœa, symptomatic of the invasion of other diseases, are noticed under the special diseases of which they form a part.

Treatment.—For practical purposes the treatment of these three forms of idiopathic diarrhœa may be founded on the following indications, namely—*first*, that in which the *tongue is clean*, the pulse quiet, and all constitutional re-action absent; and, *second*, that in which the *tongue is white* and coated, the pulse accelerated, some fever present, and the pain or soreness constant, and

increased by pressure. The stools in either case may be black, green, white, or mixed with blood indifferently.

When the *tongue is clean*, if the disease be quite incipient, the most usual practice is to give one dose, consisting of an opiate, combined with a gentle cathartic. The form may be *one grain of opium*, combined with a *drachm of compound rhubarb powder*, or combined with *five grains of calomel*. To remove any offending matter that may be present, their action may be aided by castor oil, or a saline cathartic, such as a seidlitz powder. Sometimes it may be advisable to omit the opium, and to combine antacid remedies with the purgative, as in the following prescription:—

R. Sodæ Sesquicarbonatis, Hydrogyri cum cretâ, ā ā gr. ii.—ad gr. v. ;
Magnesiæ Carbonatis, gr. iii.—ad gr. vi. ; Pulv. Rhei, gr. v.—ad gr.
viii. ; *misce*.

The administration of such a powder may be repeated at intervals. These medicines having produced their intended effect, others more distinctly astringent may be administered if the diarrhœa persists. In many cases a drachm of syrup of poppies after each stool is sufficient. In severe forms of the disease a scruple to half a drachm of the *compound chalk powder*, in some aromatic, such as peppermint or cinnamon water, every four or six hours, is an excellent remedy; and these medicines may be used whether blood be or be not in the stools. If the opiate and aromatics contained in the above medicine should prove insufficient, it may be necessary to add to each dose some of the class of pure astringents, as a drachm of the *tincture of kino*, or of *catechu*, or *hæmatoxylon*, or of *iron*.

There are cases of diarrhœa with a *clean tongue*, which will not yield to opiates, astringents, or stimulants, either singly or combined, and which probably depend on a want of tone in the intestine; and in these cases *five grains of salicine* every four or six hours have often stopped a diarrhœa that appeared fast hurrying the patient to his grave. *Tincture of the sesquichloride of iron* is similarly useful.

When diarrhœa is accompanied by a *white furred tongue*, together with pain and soreness, it is necessary to exhibit opiates, combined with some mild purgative. Thus, *half a drachm to a drachm of Epsom salts* with a *drachm of the syrup of poppies*; or *fifteen minims of the tincture of hyoscyamus*; or, in severe

cases, with *three to five minims of tincture of opium*, every four or six hours, are remedies on which, as a general principle, we may very confidently rely. In other cases *rhubarb*, *castor oil*, or any other *mild purgative*, may be substituted for the Epsom salts. In cases of diarrhœa accompanied by vomiting, a *drachm of syrup of poppies alone*, repeated every half hour, or every hour, for two or three times, often quiets the stomach, and enables it to bear the other remedies; or soda water, or the effervescing draught, with a table-spoonful of brandy, with or without a few minims of tincture of opium, often remain when everything else is rejected.

Most practitioners lay great stress on the colour of the stools, and the necessity of correcting the supposed morbid states of the liver; but the various colours of the stools are in many instances caused rather by morbid secretions from the surface of the mucous membrane of the intestines, than by any defective state of the bile in the gall-bladder; and the conclusion from this consideration is, that in simple diarrhœa, mercury in any form is either unnecessary or injurious in the majority of cases, except as a purgative. In a smaller number, however, it is sometimes necessary, and more especially in children under four years of age. One general rule may be acted on in the cure of diarrhœa, which is, that in the adult, whatever be the form of the diarrhœa, if the stools be dark at first, and then become light-coloured, purgative medicines are no longer beneficial, and in no instance ought they to be continued longer than is sufficient to remove any irritative substance accumulated in the alimentary canal.

Sulphuric acid, in doses of the officinal diluted drug, of twenty to thirty drops, with water simply, or combined with the compound tincture of gentian, has been found a useful remedy. The sulphuric acid may be alternated with the nitro-muriatic acid, and prescribed in a similar manner.

The dietetic treatment should be limited to slops, puddings, and white fish boiled, and the drink to weak brandy and water, which acts locally as an astringent, and generally as a diffusible stimulus.

CHOLERA.

Definition.—*A disease essentially of miasmatic origin, developed under certain atmospheric and terrestrial local conditions in*

Europe, Asia, and America, and capable of being propagated or diffused, to a certain extent, over the surface of the earth, through the atmosphere, or in some other way, and also by means of human intercourse between the healthy and the sick. It is characterized by premonitory diarrhœa, or sudden muscular debility, tremors, vertigo, occasional nausea, and spasmodic griping pains in the bowels, depression of the functions of respiration and circulation, and a sense of faintness; copious purging of serous fluid, succeeded by vomiting and burning heat at the stomach, coldness and dampness of the whole surface of the body, coldness and lividness of the lips and tongue, cold breath, a craving thirst, a feeble rapid pulse, difficult and oppressed respiration, with extreme restlessness (a state expressed in physiological language by the term "anxietas"), suppressed urinary secretion, blueness of the entire surface of the body, a sunken and appalling countenance, a peculiarly suppressed voice, a peculiar odour from the body, partial heats of the præcordia and forehead—fatal collapse, or re-action and secondary fever.

Pathology.—Cholera has probably always existed in England, and was described by Sydenham in the seventeenth century. The lucid summary by Dr. Farr in the seventeenth annual report of the Registrar-General, of the facts of the death statistics, *before and during* our recent cholera epidemics, in this country, in 1849 and 1854, confirms the opinion that cholera is now at least indigenous to this country; and that it is but an aggravated form of a disease continually present amongst us, its intensity appearing to depend "chiefly on local and meteorological circumstances." During recent years volumes have been written on the nature and causes of cholera; and the description of it which I here give is chiefly drawn from the writings of men who, while they have been themselves original observers of the disease throughout an extensive experience in this country, in India, and in the north of Europe, have since been the able expositors and philosophical critics of the numerous official and independent scientific accounts of it which have been lately given to the world. Dr. E. A. Parkes, Sir Ranald Martin, Dr. Charlton, Dr. E. H. Greenhow, and Dr. Berg, of Stockholm, appear to me to have given the fairest description of the state of our knowledge at this time regarding cholera in various countries.

The remote cause of this disease is unquestionably a poison,

for at no former period has a person in good health in this country been known to become in a few minutes shrivelled up; his whole body to be of an icy coldness; his face and extremities to turn purple, and, with or without vomiting of a peculiar fluid like rice water, to die in a few hours.

That this disease should spread over countries which, in respect to climate, soil, geological formation, and also as to the moral and physical habits of the population, are the most opposite to those where it first originated, is only explicable by the hypothesis of its propagation by a specific disease poison.

The doctrine now universally accepted regarding the pathology of cholera, is that a poison has been absorbed and infects the blood;—that, after a longer or shorter time, it produces a primary disease of the blood;—that it undergoes enormous multiplication in the living body of the cholera-patient, as a result of the morbid process so established; and that changes are induced in the function of respiration directly consequent upon this alteration of the blood.

“Its effect

Holds such an enmity with blood of man,
That, swift as quicksilver, it courses through
The natural gates and alleys of the body;
And, with a sudden vigour, it doth posset
And curd, like eager droppings into milk,
The thin and wholesome blood.”

So wrote our greatest English poet (Shakspeare) three hundred years ago; and by this character it has been ably shown by Dr. Wm. Budd, of Bristol, that cholera identifies itself with the group of contagious poisons which give rise to acute diseases. It is this multiplication, and the disturbance which attaches to it, that in each case constitutes the disease and destroys life. In small-pox the work of reproduction is seen in results directly appreciable to the eye. In this disease an impalpable speck of small-pox virus inserted into the skin may produce a disease which, in the course of a few days, issues in the development of a new stock of the same virus, sufficient in amount to inoculate with small-pox myriads of other persons; and although the fact may not yet be open to evidence so precise, yet it is extremely probable that, in any case of Asiatic cholera, its specific poison is multiplied in a ratio at least as great.

Another peculiar character regarding the cholera poison which

is very necessary to be remembered when we try to interpret the varied anomalies associated with cholera outbreaks, *is the tendency of the poison, when in a moist state, to rapid spontaneous decomposition and extinction.* (Budd, *Associat. Journal*, 1854.)

This characteristic accounts in some measure for the rapid subsidence and short duration of particular epidemics; and it does not seem that the poison can long subsist in the common conditions of the English climate, and hence the disease is not yet permanently established amongst us in this country. In India, on the contrary, where the disease may be said to have had its birth, the atmospheric conditions appear to be more favourable to the preservation of the powers of the poison, partly from the nature of the temperature, partly from the climate being such as rapidly to dry up the poison-holding material; so that its essence is unimpaired.

The phenomena resulting from these changes are the proper and distinctive symptoms of the disease; and the term "*algide*," first used by the French pathologists, very happily designates one of its most remarkable and constant symptoms, namely, the diminution of animal heat. The sensation of cold communicated to the observer has been compared to that experienced on touching a moist bladder or the skin of a frog. The actual temperature, as measured by the thermometer, has been ascertained by Dr. Keir, of Moscow, and by Mr. Finlayson at Ceylon; the former placed the bulb under the tongue, where it indicated 79° to 88° Fahr.; the latter placed the bulb in the axilla, where it indicated 92° to 97° Fahr.

The algide symptoms, in truth, essentially constitute the disease. In proportion to them is the malignity and rapidity of the case. They afford the only measure of its severity, and from them only can a correct prognosis be formed. The vomiting, purging, and cramps, are now considered as non-essential phenomena; for authentic cases of cholera are on record, by several of the most eminent writers on this subject, entirely divested of these symptoms; and the suddenness with which the poison sometimes extinguishes life is extremely remarkable. When the cholera reached Muscat, instances are given in which only ten minutes elapsed from the first apparent seizure before life was extinct. Instances of the apparently rapid action of the cholera

poison are related by Dr. Gavin Milroy, in a historical sketch of the epidemic of 1817; and at Kurrachee, in 1845-6, he relates that "within little more than five minutes hale and hearty men were seized, cramped, collapsed, and dead." Instances of death taking place in two, three, four, or more hours, are extremely common. When the disease broke out at Teheran, in May, 1846, Dr. Milroy states that those who were attacked dropped suddenly down in a state of lethargy, and at the end of two or three hours expired, without any convulsions or vomitings, but from a complete stagnation of the blood. In Bulgaria, during the outbreak of cholera in the allied armies, in the summer of 1854, the rapidly fatal character of the early cases was notorious. Such records confirm the views developed by Dr. Parkes, as to the essentially poisonous nature of the disease, and the very rapid depressing influence of the poison: it is plain, also, that a poison so powerful, so suddenly overwhelming all Nature's efforts at resistance, does not allow time, in many cases, for any secondary or specific actions to be set up. In those patients, therefore, who have fallen in the first stage, or within forty-eight hours of the attack, rarely has there been found any alteration of structure in any organ or tissue. After this period, however, when death takes place, the following lesions have been noticed. The follicular structure of the intestinal canal has been found to be enlarged, and the intestine filled more or less with a turbid, inodorous, semi-diaphanous fluid, usually compared to a thin starch or rice water, the remains of that immense secretion which has taken place during life, and which, being tested, has been found sometimes acid and sometimes alkaline. It is found in its most unmixed condition in the small intestines. It consists of a thicker and thinner portion, and it appears to be the latter which chiefly constitutes the "rice-water" stools, which may be passed off without admixture of the thicker substance. A layer of greyish mucus has also been found coating the whole of the mucous membrane of the alimentary canal, but without a trace of bile, although the gall-bladder is usually filled with that fluid. If the first stage has been prolonged, the mucous membrane of the alimentary canal is of a livid colour, and in some instances has presented a mammillated appearance, caused by an enlargement of the tubular glands, from which a white opaque fluid can be squeezed out, and the mamillated appearance effaced.

The liver, the spleen, and the kidneys, have in general been found gorged with blood, and this engorgement extends even to the bones, which, Louis says, appear as if the animal had been fed on madder. Professor W. T. Gairdner considers this state the natural appearance in persons dying of such very acute diseases as do not remove the colouring matter from the blood. (*Ed. Med. Journal*, July, 1849.) The bladder is contracted and empty. The membranes of the brain and cord are in general congested, and the substance of the brain dotted with more *puncta cruenta* than usual. The most common appearances in the lungs are the presence of blood in the large vessels, chiefly or solely; the collapse and the deficient crepitation, arising from the more or less complete absence of air and blood, and from the approximation of the molecular parts of the pulmonary substance. In other cases there is more blood in the minute structure, a corresponding dark colour of the lung, and a variable amount of frothy serum. The right side of the heart and the pulmonary arteries were generally filled, and in some cases distended with blood; the left side and aorta were generally empty, or contained only a very small quantity of dark blood; the left side evidently had received little or no blood, but had continued to contract, in some cases even violently, on the last drop of blood which had entered it. It was curious, also, to notice that the icy coldness of the body in the stage of collapse passed away after death, when the temperature sometimes rose to 102° or 104° Fahr.

Such are the appearances which the body has presented when the patient has died in the first, the asphyxiated, or pulseless stage. The enlargement of the follicles is supposed to be peculiar to those cases in which diarrhoea, or other disorder of the alimentary canal, had for some time preceded the fatal attack. This development bears no relation to the intensity of the disease, being often most conspicuous in the least severe cases; and it is an appearance now considered of secondary importance, and consequent on the purging. In the experience of Dr. W. T. Gairdner, it has been found in about two-thirds of the cases.

When the patient has survived until re-action has taken place, and the second or febrile stage has been formed, the body no longer presents that shrunk, worn, and livid appearance it did on death taking place in the first stage; but, on the contrary, rather

a full and plump appearance. The injection of all the large organs disappears, the blood being recalled to the surface of the body. The alimentary canal is no longer distended with the turbid secretion peculiar to cholera, but contains a thin yellowish *purée* of fecal matter, having the usual odour. The mucous membrane of the alimentary canal has now, however, been found more or less diffusely inflamed, sometimes in all its divisions, but more especially in the pyloric portion of the stomach, and also in the duodenum. The Plaques of Peyer, as well as of the solitary glands, though occasionally found enlarged, were seldom found ulcerated; but when that was the case the corresponding mesenteric glands were also enlarged, being sometimes pale or purple, and when cut into gave issue to a dark liquid blood.

The *post-mortem* appearances, and the order of the symptoms, tend to show that the blood is obstructed in its passage through the lungs; and, that the loss of animal heat, embarrassment of the respiration, and gradual arrest of circulation, are produced by some aberration of the proper respiratory changes, or impediment to them. But as the mechanical part of respiration remains perfect, and as there is no impairment in the voluntary command of the respiratory muscles, and as the heart evidently beats in many cases till stopped by the want of blood on the left side, and by its accumulation on the right side, "we are compelled to look," says Dr. Parkes, "for the cause of such arrest of the circulation in the only remaining element of respiration, namely, in the blood itself." (*Researches into the Pathology and Treatment of Asiatic or Algide Cholera*, p. 107.) Dr. Parkes, and Dr. Garrod, of London, and Schmidt, of Dorpat, have made the most important researches on the chemistry of the blood in cholera. The latter observer has attempted to trace out the exact chemical steps which attend the period of transudation *from* the blood into the intestinal canal. The most prominent phenomena of cholera, during this period of transudation, consists in "separation of the water and of the salts of the intercellular fluid (of the blood), through the mucous membrane of the intestinal canal, and the retention in the blood of an important excess of albumen, and of blood cells, with apparently less, but in reality with great diminution of the salts and fibrine." The period during which this transudation takes place is generally one of short duration (about thirty-six hours), and in it the serum and fibrine (intercellular fluid of the

blood) are first affected; and water, salts, and a small portion of albumen, pass off, and form the well-known liquid stools. The order in which the constituents of the serum are affected is thus stated by Schmidt:—The water transudes before the solids of the serum; the inorganic before the organic solids; the chlorides before the phosphates; the salts of soda before the salts of potash; and, it is interesting to observe, that the order is very much the same as takes place during the action of some purgative medicine, such as elaterium. Very soon after this transudation of some of the constituents of the serum commences, an important change occurs in the blood: the normal diffusion currents between its fluid part and the fluid in the blood cells alter; and the constituents of the blood cells transude into the serum, in the same order as the constituents of the serum transude into the alimentary canal; that is to say, the water diffuses more readily than the solids; the inorganic solids more readily than the organic; the chlorides, and of these the soda salts, more readily than the phosphates. The result of all these changes in the fluid of the blood and in the blood cells is, that at the height of the transudation period the constitution of the blood is profoundly altered. The inorganic constituents, if compared to the water, are during the first four hours increased, because at this time the water is passing off with great rapidity; afterwards, as the salts pass off, the disproportion is lessened, and after eighteen hours or so the proportion of salts is greatly diminished, and, if compared with the organic constituents, the diminution is enormous. With respect to the individual salts, there is in the blood a relative preponderance of phosphates over chlorides, and of potash salts over soda salts. By the end of eighteen hours or so, the blood corpuscles are left in a most abnormal condition; the great loss of water and of salts, especially of the chloride of potassium (a most important constituent of the blood cells), at once leads to the conclusion that their functions must have been greatly impaired. Schmidt accordingly found that the amount of oxygen contained in them was lessened by one-half.

According to the observations and analyses made by Dr. William Robertson, of Edinburgh, the fibrine of the blood is usually in large amount, and coagulable with great firmness. On the other hand, defective or imperfect coagulation of the blood in cholera was observed by Dr. Parkes as occurring in

little less than a quarter of the whole number of cases observed by him. The presence of fibrine in the blood was not indicated by any coagulation, either in or out of the body; and whether coagulated or not, the blood has usually a dark colour; but generally acquired an arterial tint when brought into contact with the air in thin layers. Dr. Robertson's observations were made on the cases occurring in the Edinburgh epidemic of 1847 and 1849; while Dr. Parkes's observations were made on two severe epidemics of cholera in India in 1843 and 1845. He also made the interesting observation, that a few drops of the thick substance taken from the intestines had sometimes the effect of restoring the vivid arterial colour of the blood. During the transudation into the intestinal canal it appears that the diffusion currents from the blood into various structures are diminished; while, on account of the density of the blood, the inverse currents from these structures to the blood are augmented in rapidity. In this way fluids are drawn from the muscles, the viscera, and, in fact, most of the tissues; and it is probable that these fluids are charged with substances (such as sugar, &c.) which, under ordinary conditions, are taken very much more slowly into the blood, and are soon decomposed when they get there. The extent to which the blood is contaminated and injured by this admixture, and also by the retention of urinary constituents, is not yet accurately known. "When we remember," says Dr. Parkes, "the great share taken by the blood globules in the respiratory and heat-furnishing processes, it is scarcely possible to avoid concluding that their loss of salts connected with the characteristic cyanosis and lowered temperature in cholera. In most cases there is vomiting and purging before there is loss of heat, though this very soon follows in slight degree, and then gradually augments. In other words the diarrhoea coincides with the first chemical changes in the blood, the transudation of some of the constituents of the serum and the lowered temperature follows afterwards, at the time when we know that the diffusion from the blood cells into the serum must be taking place, and augments gradually as the diffusion increases." In all the cases examined by Dr. Marcus at Moscow in 1832, the clot and serum evinced acid qualities on the application of litmus, except in four cases, where the discharges were watery and the re-action alkaline. The phenomena of the disease

may thus be traced from the transudation of serum constituents as the starting point, all the other chemical changes in the blood, and the most marked symptoms, such as the abnormal respiratory process, follow as a matter of course.

Such is the nature of cholera, according to the observation of Drs. Parkes, William Robertson, and Schmidt; and thus "an early theory of the nature of this disease has received the support of one of the best chemists of the day—namely, that the blood is the primary seat of the disease, and becomes contaminated by the absorption of a specific poison introduced (probably) by the lungs."

Symptoms and Various Forms of Cholera.—Cholera Indica has many degrees of severity, and hence many pathologists have divided it into *Cholera Indica mitior*, and into *Cholera Indica gravior*. The French have termed the slighter forms of the disease *Cholérine*; and this name has been also recently used by Dr. Farr to designate the zymotic matter of cholera.

The Cholera Indica is divided into two stages, or into the cold, pulseless, or asphyxiated stage, and into the febrile stage, when the patient outlives the first. This latter stage, however, is not essential to the disease, and has been observed in India in a small proportion of the cases only. In Europe, however, the febrile paroxysm has followed in the majority of instances. The duration of the cold stage varies from a few minutes to twelve, twenty-four, forty-eight, or even more hours; while the febrile stage lasts from four to eight or more days,—making the total duration to vary from a few hours to two, three, or even four weeks.

The attack of this fatal epidemic is most commonly sudden, the patient at the time of his sickness being apparently in his best health; yet not unfrequently slight diarrhoea or other general indisposition has preceded it. In India, in some cases, the premonitory symptoms are vertigo, noise in the ears—the latter sometimes so loud as to have been compared to the humming of a swarm of bees, to the beating of drums in the camp, or to the roaring of the surf on the Coromandel coast.

A classification may be made of the disease into three principal varieties, which coincide in their phenomena with many of the changes known to take place in the blood (PARKES).

1. The slighter forms commence with much watery purging and vomiting, and pass into the second and third varieties in varying

times. There may be from ten to fifty copious watery stools, and frequent copious vomiting, before there is any great loss of heat and failure of circulation. But there is always some degree of this even in the slightest cases, else the case would be mere watery diarrhoea, attended only by exhaustion, and not by the symptoms peculiar to cholera. Cramps are seldom present till the stools put on the true choleraic character, viz., of copious white flocculi suspended in a watery fluid. The algide symptoms come on gradually, and are less intense than in the following forms; recovery is also more common.

2. If the poison acts with greater intensity, we have the second variety, in which there is less physical alteration in the fibrine, and the circulation is carried on for a longer time. Consequently, the characteristic change is not evidenced solely or chiefly in the interior of the vessels; but is partly transferred to the exterior of the vascular system. The albuminoid constituents, fibrine, and perhaps albumen, are effused in large quantities, and in all parts of the body, though chiefly on the free surfaces of the skin, alimentary mucous membrane, and more rarely the bronchial mucous membrane. This effusion, and its general nature, form two characteristic distinctions between cholera and diarrhoea; for diarrhoea is a disease confined, in the first instance, to the eliminating part, viz., the large or small intestines, as the case may be, and is unattended, as a general rule, by the effusion of albumen and fibrine. The worst forms of this variety are seen in those cases in which, after two or three choleraic stools, severe and long-continued cramps come on, accompanied and followed by intense algide symptoms; after death the small intestines are generally found distended with the thick, white, flaky substance. Other cases of this variety present infinite modifications in severity, according as watery elimination is added to effusion of the fibrine; in other words, according as they tend towards the slighter forms.

3. Thus, if the final change at once occur, and there is a complete and rapid arrest of the circulation, either from the intensity of the cause or from constitutional predisposition, the worst variety is produced, in which "a mortal coldness comes on from the beginning." As the circulation is soon almost entirely arrested by physical alterations in the blood—presumably, changes in the fibrine—there can be little purging and comparatively little sweating; there is always some effusion of the thick white sub-

stance into the intestines, but often little of the watery part of the blood. The symptoms might be inferred from a statement of this condition: we might have presupposed a very rapid loss of animal heat, loss of voice, deafness, and vertigo, total arrest of all secretions, defective aeration of the blood, consequent dark colour of the surface, and early and deep coma.

The more usual course of the disease in this country, when limited to the cold stage, is as follows:—

After the patient has been troubled for a few days with diarrhœa (the more insidious and dangerous because it is *painless*), but more commonly while he is yet in perfect health, and has retired to rest, and has slept soundly till the middle of the night, or onwards till early morning, he is suddenly seized with an unaccountable sickness and vomiting, together with a most profuse discharge from the bowels. These evacuations are attended with severe pains down the thighs, and more especially by an indescribable and subduing sense of exhaustion, the patient often fainting in the water-closet. In an instant the physical powers of the body are not only exhausted, but its temperature sinks rapidly below the natural standard, and an icy coldness benumbs it; while the skin is sometimes rendered so insensible as to resist even the action of boiling water or other powerful chemical agent. The breath, as it issues from the mouth, has a glacial feel; still, notwithstanding this great loss of temperature, the patient complains of being oppressed, and is incessantly throwing off the bed-clothes, while cold water, copiously and eagerly drank, is grateful to him, although it does not seem to afford any relief to his insatiable thirst.

The extreme coldness of the first stage is further accompanied by a blue, livid, or purple discoloration of the hands and feet, extending not only a considerable way up the arms and legs, but sometimes over a great part of the body. These parts often become, in a few minutes after the seizure, not merely shrunken, but singularly wrinkled, like the hands of a washerwoman after a day's hard labour. These symptoms are rendered still more distressing by the shrieks and groans of the poor sufferer, often tortured by spasms, which affect the fingers, the toes, the arms, and the legs—spasms which clench the jaw, fix the walls of the abdomen in contact with the spine, or draw the trunk into singularly contorted forms. The patient thinks he obtains some

relief by the use of friction, and his cries to his attendants incessant to "rub hard."

As the disease proceeds the countenance assumes a character peculiar to this great struggle, the "*facies cholericitica*," the being deeply sunk, red, and injected; while the aqueous humor transuding its coats, leaves the cornea flat and depressed as in dead body; a broad and livid band encircles the lower part of the orbit; every feature, moreover, is sharp and pinched after a long disease; the complexion thick and muddy; the lips and tongue purple; and all these great changes have been known to take place in a few minutes.

In addition to this sad state the vomiting is constant, purging most incessant, and the pulse, though generally natural, sometimes rapid, yet in some cases is not to be felt, even from the first moment of the attack, either in the large superficial arteries or at the wrist. The voice is strangely altered, the firm and manly tone changes to a low, feeble, unnatural, almost sepulchral sound. The urinary secretion is likewise entirely suppressed, while no bile flows into the intestines. The only organ which seems to preserve its powers is the brain; and the patient often to the last moment of his life retains the power of thinking and of expressing his thoughts distinctly, sometimes full of hope, while at others he seems indifferent to the fate which too often inevitably awaits him.

On the accession of the spasms, the vomiting, and the purging, the disorder is fully developed, and the crisis is at hand, which in a few hours must decide the fate of the patient. The termination may be favourable or unfavourable; if unfavourable, he may continue with all the symptoms narrated strongly marked; or should it be favourable, they may abate, and a happier prognosis be formed. Unfortunately, however, it too often happens that, although the stomach retains what is taken, and the purging appears checked, and the patient falls into a dose, yet the weakness, the entire cessation of the pulse, the coldness and lividity of the surface, and the ghastly expression of the countenance, show that a few hours must close the scene. This melancholy result occurred in Gendrin in seventeen out of twenty cases, and often with so little struggle that death was only marked by the phenomena of cadaveric contraction, which sometimes continue active in the muscles for some hours after death.

If the patient should happily survive the cold stage, the disease may terminate by a rapid recovery, or it may pass into the second or febrile stage. The former is the more usual course in India, the latter in Europe. The first symptom of returning health is shown by the patient falling into a sleep of unusual soundness, during which the respiration becomes light and easy, the pulse freer, while a gentle, warm perspiration bedews the whole body. This grateful pause in the disease appears to be the result of the returning powers of life, uninfluenced by medicine, for it often occurs where none has been given. After this balmy slumber the patient awakes refreshed, and often recovers so rapidly that in the natives of India it almost resembles a restoration after syncope. In all the presidencies, indeed, and especially in Bengal, the recovery of the European has, in general, been followed by a stage of re-action, usually slight, but in some cases assuming the form of the bilious remittent fever of the country, and which has occasionally terminated fatally.

In Europe, restoration after the cold stage, and without febrile re-action, is by no means so frequent or so rapid as in India. Sometimes the re-action is trifling, and sleep may indeed have ensued, fæcal evacuations containing bile may have passed, the urine may again have flowed, the purging, vomiting, and spasms may have subsided, the pulse may have risen, the blueness may have disappeared, and the temperature of the body may have increased, yet in many instances this amelioration of the symptoms was only temporary;—the patients relapsed and died.

In most cases, however, the re-action was more considerable, and the patient, in a few hours after the subsidence of the cold stage, laboured under a severe form of fever, in no degree dissimilar to, and not less fatal than typhoid fever. These *typhoid* symptoms, common in Europe and America, are said to be unknown, or nearly so, in India, where, if a secondary fever ensues, it assumes the form of the remittent fever of that country. For the first few hours after the febrile re-action the tongue is white, but it quickly becomes brown and dry, while black sordes incrust the teeth and lips. The eye is now deeply injected and red, the cheek pale or flushed, the pulse rapid, and the temperature of the body a little above or below the natural standard; and the patient, either delirious or comatose, lies in a state resembling the last stage of the severest typhoid fever of this country. This

struggle usually lasts from four to eight days, when the symptoms either gradually yield or death ensues. In a few mild cases fever assumes an intermittent type, or sometimes a quotidian, sometimes a tertian form: all these cases usually recover. § is a general outline of the symptoms of this formidable disease.

The blood in cholera varies according to the stage; and taken in the cold stage is usually of an unnaturally dark colour and thick consistency, so that it flows with difficulty from veins, and very imperfectly separates into clot and serum. Blood taken from the temporal artery has been found equally black and thick. After the secondary fever is formed the quantity of serum increases, till at length it is much more abundant in blood than natural; and it is singular that this takes place, notwithstanding that the secretion of urine is re-established.

Origin and Modes of Propagation of Cholera.—One of the most interesting facts brought out by Dr. Farr, in his report already noticed, is, that diarrhoea, summer cholera, and diseases of choleraic character, have been unusually fatal in England several years of the present century; that the mortality from them suddenly rose in 1827, and progressively increased till 1838, and that diarrhoea has continued to go on, gradually increasing fatality, since 1838. It proved fatal, *per se*, evidently as a variety of cholera, chiefly to young children and to old people, who do not so commonly exhibit the spasms of cholera (which we have seen are not essential to the disease), but died with nearly all the other symptoms of the malady. It proved fatal as a cause of death in other diseases. "It killed sick and dying men;" and now, at least, we believe that cholera is indigenous to this country; and assuming, therefore, that it is produced by the action of a poison, whence does it originate, and how is it produced?

The chronological and geographical history of cholera has commonly been considered as affording *primâ facie* evidence that it is an exotic disease, the product of another climate, which has in this country met with conditions favourable for its development. Some believe that it has been transplanted by human intercourse into this country; others, that it has spread from its Eastern birthplace in Jessore by means of some hidden telluric influence.

Several explanations, or theories, have been proposed, to explain the production of cholera in this country. According

Sir Ranald Martin, they may be referred to the following six heads:—

1. That the disease spreads by an *atmospheric influence or epidemic constitution*, by a succession of local outbreaks, and that the particular localities affected are determined by certain "*localizing conditions*," which are—*first*, all those well-known circumstances which render places insalubrious; and, *second*, a susceptibility to the disease in the inhabitants of such places, produced by the habitual respiration of an impure atmosphere.

2. That the cause of cholera is a morbid matter which undergoes increase only within the human body, and is propagated by means of emanations (or discharges) from the bodies of the sick; in other words, simply by contagion in the most limited sense of the term.

3. It is supposed that the poison of cholera is swallowed, and acts directly on the mucous membrane of the intestines, and is at the same time reproduced in the alimentary canal, and passes out, much increased, with the discharges; and that these discharges afterwards, in various ways, but chiefly by becoming mixed with the drinking waters in rivers and wells, reach the alimentary canals of other persons, and produce the like disease in them.

4. Assuming that the cause of cholera is a morbid matter or poison, it is supposed that it is reproduced in the air, as well as within the bodies of those whom it affects, and that its diffusion is due to the agency of the atmosphere.

5. It is supposed that the cholera poison is increased by a species of fermentation, or other mode of reproduction, in impure, damp, and stagnant air, and it is maintained that it nevertheless is distributed and diffused by means of human intercourse, it being carried in ships, and other vehicles, and even in the clothes, especially in the foul clothes of vagrants, and the accumulated baggage of armies.

6. It is assumed that the material causes of the disease may be increased and propagated in and by impure air, as well as in and by the human body.

All the theories agree in assigning an Eastern origin to the poison of cholera, which is believed to have either reached this country by means of direct human intercourse, as by fomites or individual contagion; or the poison itself is assumed to be migratory, and to have come hither by a kind of wave-like extension from India.* All of the suppositions (with the excep-

* Our knowledge of the progress of cholera in Great Britain was originally contained in an official report presented by the commissioners to his Majesty King

tion of the *third*, propounded originally by Dr. Snow) consider the existence of certain local conditions, or of a predisposition in the inhabitants of infected districts, as usually necessary to give strength and vitality to the poison. It is also to be observed, that while each of the six opinions, or theories, just noticed, is apparently supported by a large amount of evidence, direct and circumstantial, each is also equally opposed by a "considerable number of obstinate facts." All of them, however, agree in two main points—namely, that cholera is induced by a special poison, and that this poison is of foreign extraction.

But on the other hand there are good grounds for believing that cholera has not in the present century for the first time appeared in this country, and extended itself over the greater portion of the habitable globe. The "*cholera morbus*" of Sydenham, prevalent in his time, and the "*griping in the guts*," or "*plague in the guts*," as recorded in the mortality bills of 1665, and described by Willis, and subsequently by Dr. W. Heberden, jun., do not seem to differ in their essential phenomena from the disease supposed to be imported into this country from the East; although some believe that these statements refer to dysentery, and not to cholera.

There are also abundant facts which seem to show that, under a different name, cholera was one of the most fatal epidemics by which the population of London was formerly afflicted. And there is no doubt that cholera, like every other epidemic disease, varies in its type, as it does in severity; for, if it is conceded that the diarrhœa, so prevalent during an epidemic of cholera, arises from the same cause, and is, in fact, the same disease in a different degree of intensity, "there is as much variety in the aspect and symptoms of cholera as of scarlet fever; between the malignant cases of which, and the extremely mild ones, there is so vast a difference."

There are also facts which seem to show that the population of this country has been undergoing a morbid change, as regards the tendency to diseases of the flux character, during the second quarter of this present century; and which facts, while taken

William IV., of which only one copy existed. This was rescued from oblivion by Sir James Clark, aided by the Royal Librarian, who found it in a drawer buried among a heterogeneous mass of papers. It is now appended to Dr. Graves's "*Report on the Progress of Cholera*."

altogether, are opposed to a common opinion that cholera is imported by means of human intercourse, yet, they are nevertheless not incompatible with this opinion, or with that expressed by Dr. Farr, "that while the materials were smouldering in England, the flame which threw the mass into combustion has been of Asiatic origin." A very careful inquiry into the history of the earliest cases of cholera in London, by Dr. Parkes, in 1848, and in Newcastle by Dr. Robinson, shows that the poison could not have been brought by the clothes or baggage of any persons coming from infected districts in England, or elsewhere on the Continent; still, those inquiries do not absolutely *exclude* the possibility of importation. Some analogous observations were also made in Scotland; for example: in one of the Western Islands, the most remote from the main land, the disease suddenly appeared, when so little intercourse existed with the place that the clergyman of the island continued regularly every Sunday for eighteen months to pray for King William the Fourth as if he had been alive, after our gracious Queen Victoria had ascended the throne.

It seems on the whole, therefore, not improbable that the modern cholera is but the re-appearance of pestilential disease amongst us, in a form familiar to our ancestors, and known as a yearly autumnal visitor since the days of Sydenham; and that now, at least, the evil is one which has become indigenous.

But other and occasional circumstances are required to give energy to the development of the poison of cholera. These have been described under the two heads of "*meteorological conditions*," and "*localizing causes*."

Of the first of these, temperature appears to have a marked influence. The average temperature of 1846, in which the mortality occasioned by diarrhoea, cholera, and dysentery was very large, was 4° higher than that of 1845, and 3° above the average of the six preceding years, and the fall of average temperature was accompanied by a corresponding fall of mortality, from the choleraic and flux diseases. Dr. Barton, of New Orleans, states that cholera always co-exists there with an east or south-east wind; a temperature above 70° Fahr. increased as the disease attained its maximum, a dew-point of from 60° to 70°, and a barometric elevation of over 30°. The maximum barometer occurred on November 18, 1853, and was 30°·46 (a very unusual height), soon after which cholera broke out. During December the wind

continued from the east, north, and north-east: the maximum barometer was $30^{\circ}48$ on the 2d, when the cholera was at its height, and declined to its minimum, $20^{\circ}57$, on the 30th. The cholera ceased soon after the middle of the month.

The first epidemic of cholera in this country, during the present century, began in the north of England, in October and November, 1831. The preceding summer was unusually fine, the nights being warmer, in proportion, than the days. In November, December, and January, the atmosphere was observed by many independent observers, both on land and sea, to be *singularly stagnant, unusually still, close, and hot*, so that it was impossible to ventilate even large houses, in which no change of air "seemed to take place for almost a week together." According to the delicate and accurate observations of Mr. Glaisher, the meteorological phenomena of the three visitations appear to have been remarkably similar (excepting as to temperature), and especially as to the misty condition of the atmosphere, which was thin in high places and dense in low, the absence of motion in the air, remarkably high readings of the barometer, and a total absence of ozone. Indian medical officers, and those of the Black Sea fleet, give similar accounts of these meteorological phenomena which attended the outbreaks of cholera in their experience. Such meteorological conditions have a marked tendency to *favour the chemical decomposition of organic substances, and to render the season defective in those atmospheric changes which, by decomposing and dispersing into space the products of decomposition, renew the purity of the air.* "The effect of temperature upon the Thames water is very remarkable in tainting the surrounding air, and is exhibited in the well-known fact that diarrhoea and summer cholera become prevalent among the inhabitants along the banks of the Thames after the temperature of the river has attained to 60° , and as the water declines from this temperature so do these diseases in its vicinity." In Europe all the great epidemics have occurred in times of prolonged drought; and the dissemination or dispersion of the disease is very closely related to rainfall, as Dr. W. Budd, of Bristol, has shown. By diluting the poison, and by giving rise to floods which rapidly sweep it beyond the inhabited area, rain seems to have a powerful influence in checking the disease. But to have this effect the rainfall must be heavy and continuous—while, on the contrary, light and intermittent rains may favour its spread.

The general result of all such observations is, "that whilst cholera may prevail within a considerable range of temperature, a moderately elevated one is most suitable for its development; and this, accompanied by a still, stagnant, and peculiarly oppressive condition of the atmosphere (more oppressive than the elevation of the thermometer can account for), and a moderate amount of moisture." With regard to the apparent anomaly as to temperature in the case of its outbreak in Moscow and in the northern countries of Europe, such as in Sweden and Norway, it must be remembered that the internal atmosphere of the Russian, Swedish, and Norwegian houses are maintained at a high elevation during the winter months by means of stoves. It must be remembered, too, that the water used by the Russians in winter is often got from the melting of snow in the vicinity of the houses, and which snow is generally exposed to the reception of various excreta from the houses, just as the surface of the soil would be exposed. Hence facilities for its spread in Russian hamlets.

Although meteorological statements appear to be a mass of confusion, from which we can scarcely deduce a single general principle; yet we know that organic germs, and seeds of various kinds, are capable of preservation under the most different and variable meteorological conditions; and also that particles or germs most microscopically minute are capable of actual demonstration in the air we breathe, as already stated at page 458.

But in order to give character and energy to the development of cholera, there are other conditions required besides those meteorological phenomena just noticed. These other conditions are described by Dr. Barton as the "*terrene element*," and correspond with what in this country have been termed the "*localizing causes*" of cholera.

That some local circumstances play a very important part in the evolution of cholera is evident from the following facts:—

1. An analysis of the history of cholera epidemics show that they are most frequently made up of a succession of partial local outbreaks, not only in different districts, but even in the same place.
2. The pestilence has also been observed to linger in some few favourite haunts throughout the entire course of an epidemic; and that, now and then, after visiting a place at the commencement of an epidemic, it has returned to it again, after an interval of complete immunity, before its close.

3. That some places escape an epidemic visitation at the very period when others in the immediate vicinity are suffering severely from its presence, the meteorological influences being the same. Even in the same town, whilst the inhabitants of some streets or courts are being decimated, those dwelling in others not far distant altogether escape; or, as frequently happens, the inmates of certain houses suffer severely, whilst their neighbours are entirely spared.

4. That the limits of a tainted district are sometimes clearly marked out. In illustration of this, my amiable teacher, the late Dr. W. P. Alison, Professor of Medicine of Edinburgh University, quoted a most striking example in his paper on "The Exciting Causes of Epidemics," in *The Medico-Chirurgical Review*, for 1854. He wrote (on the authority of Ashton Bostock, Esq., Surgeon of the Guards), that *one wing of a cavalry regiment, just arrived from England, and in high health, ascended the Ganges from Calcutta in boats, there being no cholera at the time in Calcutta. At a certain period of the voyage the troops arrived at a part of the country where cholera prevailed in the villages on the banks of the river, but with which they did not communicate. Here cases of cholera occurred in the boats; the men were advised to push on rapidly, and after a few days, when they had passed the limits of the existence of the disease on the banks, it ceased to show itself in the boats. What makes the case peculiarly conclusive is, that the other wing of the regiment followed afterwards by the same mode of conveyance, became "affected with the disease at the same point, and lost it again at the same point."*

Although very great differences of opinion prevail as to the part which obvious local causes of insalubrity bear in the production of cholera, yet it is almost universally considered that they are necessary for the development and propagation of this disease in its epidemic forms. Drs. Barton, Carpenter, Pettenkofer, and Snow, all agree in this general proposition. But Dr. Carpenter believes that the disease, being zymotic, may be induced by personal, as well as by local causes.

Impure water, lowness of site, and the emanations arising from the decomposition of animal refuse, are the local causes now satisfactorily determined to have a more or less constant connection with the development and propagation of cholera.

That *impure water* has a powerful influence over the intensity of cholera outbreaks is now unquestionably established by the observations of Drs. Acland, Sutherland, William Budd, and the late Dr. Snow, and the specific inquiries of the Registrar-General.

Yet still it is found that *impure water* is not a necessary element in the generation of the cholera poison, as shown in the report of Dr. Baly (page 201-5); and just as unwholesome food, or the injudicious use of purgatives, are determining causes of cholera, so is water impregnated with organic impurities or certain salts.

As regards London, it has been shown by Dr. Farr that *the elevation of the soil* has a more constant relation with the mortality from cholera, than any other known element; the mortality from cholera being in the inverse ratio of the elevation. Yet, like the condition of the water, the elevation of the soil has not been always found to be a necessary localizing condition, and there is now only left to be noticed *the influence of an atmosphere contaminated by the effluvia arising from decaying animal matter*. Dr. Cullen long ago remarked, and every industrious dissector knows, that the effluvia from very putrid animal substances readily produces diarrhoea. Yet it appears that the nature of the decomposing matter, and of the transforming process it undergoes, have some influence in modifying the effects on the human constitution. Districts in which the most powerful putrid odours tainted the air have sometimes almost entirely escaped, whilst others contiguous to them have suffered severely. Dr. Chisholm (quoted by Dr. Alison in his paper already referred to) gives numerous pointed illustrations of this, in the cases of "bone manufactories," "manufactories for the conversion of dead animal matter into a substance resembling spermaceti," "of places where blood is putrefying, waiting to be used by sugar refiners," and "of leather-dressing establishments." In dissecting-rooms, where the process of animal putrefaction goes on to a great extent, diarrhoea is comparatively rare, if the rooms are kept clean. During my experience, as Demonstrator of Anatomy, in the University of Glasgow, for a period of six years (including the severe epidemic of cholera there, in 1848-49, and during which time almost all the subjects for dissection had died of cholera), not a single student suffered from cholera; and when the proper agents are used, such as the injection of arsenical solutions into the dead body, which have the effect of arresting and modifying the putrefactive changes, I believe the production of diarrhoea is an exception, and may be found to have as significant a cause in errors of diet or of drinks as in too close an attendance in the dissecting-room. That the poison of cholera does not attach itself to the *dead body*, in a certain state of decomposition at

least, is a fact confirmed by the experience of those connected with the dissecting-rooms in Edinburgh. It is certain that these were supplied during the greater part of 1848-49, as they were in 1832, almost exclusively by cholera subjects, and in neither year was there a single case of the disease among the numerous students attending these rooms (DR. ALISON).

Much pains has been taken by Dr. E. H. Greenhow to investigate the precise conditions which, from their more uniform co-existence with cholera, might be supposed to produce or to aggravate epidemics of it. The result of his observations tend to show that "an atmosphere impregnated with the products of *fermenting excrement* is at once the most obvious and most constant concomitant of cholera. Such exhalations were often found, even in a concentrated form, in houses where the existence of any palpable cause of insalubrity would scarcely be suspected, and thus the fact is in some measure explicable, that the pestilence, sometimes passing over slums and rookeries, knocked at the door of the comfortable annuitant or the wealthy tradesman. It was found that persons appeared to suffer in proportion to the contamination of the air they breathed with the '*privy odour*,' and that immunity from this appeared to secure immunity from cholera." These observations of Dr. Greenhow are confirmed by the investigations of Dr. Pettenkofer at Munich and at the village of Gaimersheim. Dr. Barton, of New Orleans, Dr. Milroy in his report on the epidemic at Kingston, and Dr. Buckler in his account of the outbreak in the Baltimore alms-houses, give similar evidence confirmatory of the injurious influence of the *fermentive decomposition of animal excrement*.

The outbreaks of cholera in some of the camps in Bulgaria and the Crimea, especially at Aladyn and Alma during the war, also furnish sufficient illustrations; and I believe the outbreak of cholera at Scutari, in November, 1855, which suddenly commenced in the camp of the Osmanli Horse Artillery, had a similar origin.

Propagation of Cholera by Human Intercourse.—When cholera appeared in its epidemic form in this country in 1831, the majority of European practitioners were decided contagionists. Subsequently to that period a re-action of opinion occurred, and the question was discussed for many years without any definite result. In 1848, when the disease again became epidemic, many of the higher authorities coincided with "the solemn declaration of the Board of

Health, that the malady was not in any way contagious, and that no danger was incurred by attendance on the sick.

“A large body of evidence, however, now renders it certain that human intercourse has at least a share in the propagation of the disease, and that it, under some circumstances, is the most important, if not the sole means of effecting its diffusion” (DR. BALY). But, at the same time, it is argued, that although thus spreading in many cases by the agency of human intercourse, it does not follow that the material cause spreads by true contagion,—that is, by reproducing itself in the bodies of men, and there only. Healthy men only carry the disease with them in their clothes, in their ships, and in their caravans. That such is the case, we have now ample evidence in the *Bengal Report*, by Dr. Jamieson, of 1824; in cases related by Dr. J. Y. Simpson, in 1838; in *The Edinburgh Monthly Journal* for 1849, by the late Dr. Cruickshank, at Dalmellington, in Ayrshire; by Dr. William Robertson, detailed in *The Edinburgh Monthly Journal* for August of that year, and more recently the account of the outbreak at Arbroath, in Scotland, in 1853, by Dr. T. Trail; and cases by Dr. Alison, in 1854, in the paper already noticed; in the report of Dr. Berg, of Stockholm, in 1848; in the Norwegian Reports of 1850-53; in the Report of the College of Physicians of London in 1854. These records afford undoubted instances which show that human intercourse is occasionally influential, in some way, in transmitting cholera into detached localities, where it may seize upon two or more individuals, and then cease. But it is no less certain that its general extension over the world cannot be accounted for by human intercourse alone. Its propagation by this means seems to be the rare exception, its spread from other causes being the common rule. It is curious that in India, the birthplace and headquarters of the disease, the doctrine of contagion is almost universally disbelieved in by our professional brethren. The opinion generally entertained in India is opposed to the doctrine of contagion. (Morehead, *Indian Annals of Med. Science*, vol. i., p. 456.) Such difference of opinion may admit of explanation in the fact, that in India all the predisposing causes of cholera are in constant operation, and more especially prolonged heat, decomposing organic matters, a more or less debilitated state of the European constitution; and hence no sooner is the poison or germ of cholera imported, than the disease spreads with such rapidity as

to resemble an epidemic invasion. Cases of undoubted contagion are not wanting in India. Mr. Barry, of the Bengal service, records an outbreak of cholera at Gowalparrah, in Upper Assam, in 1853. In this instance the cholera was evidently imported into a healthy locality by a body of Sepoys coming from an infected locality. Every case of the disease could be traced to communication with the sick: a large number of attendants on the sick were seized, but those who separated themselves escaped in every instance. (*Ind. Annals*, vol. i., p. 448.)

According to the accurate observations of C. T. Kiërf in the vicinity of Bergen, it appears that, when the disease is propagated by human intercourse, from one to four days elapsed from the supposed period of infection to the outbreak of the disease. Most frequently the disease appeared on the second day after exposure to the infection; and he found that the diarrhoea, so frequent during the invasion of cholera, is a part of the disease, and itself capable of infecting others with true cholera. The extreme shortness of the period of incubation is an important element to be remembered in all investigations regarding the course of events in cholera epidemics. According to Dr. Budd's observations it seldom exceeds three days; and where the disease is virulent, there is evidence to show that it may not exceed six hours.

The inoculation experiments of Namias with needles loaded with the evacuations from cholera, and the experiments by tasting the vomited fluids by M. Foy and his coadjutors, have given entirely negative results. So also the influence of exhalations from the blood and evacuations of patients with cholera, as designedly experimented on, has been of a negative kind. On the other hand, Lauder, Lindsay, Marshall, Thiersch, and Meyer, have succeeded in communicating cholera to dogs and cats, chiefly through the *rice-water* evacuations from cholera patients. Dr. Wm. Budd, of Bristol, maintains, with most cogent reasoning and evidence, that the poison is cast off by the intestine of the cholera patient, in the characteristic *rice-water* discharges, and that it may be transmitted to other and uninfected persons in the following principal ways:—

1. By the soiled hands of attendants on the sick;—a mode of communication probably very common within the limits of the family circle.

2. By means of bed and body linen, and other articles tainted with the *rice-water* discharges.

3. Through the medium of the soil. The discharges being liquid, the great bulk of them find their way to the ground, from which the poison may be propagated in three ways,—(a.) By rising into the air as a product of evaporation; (b.) By percolating into the drinking water; (c.) By atmospheric dispersion in the form of impalpable dust, after it has passed into the dried state. It is, of course, difficult to establish these modes of propagation by direct proof; but circumstantial evidence, and evidence by analogy, is so cogent and weighty, that no reasonable doubts can now be entertained regarding these modes of propagation. By *experiment* the *enthetically* contagious poisons (*e.g.*, vaccine, variola, woorara, &c.) are known to retain their properties in a dormant state for indefinite periods of time after having been dried up; and to recover these properties again when moistened. Evidence almost as certain as experiment demonstrates the same regarding the poison of scarlet fever, malignant pustule, glanders, and syphilis. Therefore it is probably true of cholera, and the more so that the numerous and well-authenticated instances of the propagation of the disease through articles of dress, shows that the poison, during its transit, must necessarily have been in a dried condition—a condition which entirely protects organic bodies from certain molecular changes; so that, so long as the material-holding poison remained in this dry state, no definite limit could be stated as to how long the morbid agent might retain its specific powers. From this point of view a single case may give rise to a wide-spread infection; and as cases multiply, it becomes more and more impossible to trace their lineal succession.

The relative share which the modes of propagation (here indicated by Dr. Budd) take in the propagation of cholera must vary with season and climate, with temperature, with the habits of the people, with the nature of the soil, with the water supply, with the prevailing wind, and with general sanitary arrangements.

The rapidity with which the rice-water discharges must pass into a dry state under the burning rays of a tropical sun, renders it highly probable, as Dr. Budd suggests, that in India “dust” bearing the poison of cholera in a dry state (“cholera dust”), has a large share in the mode of propagation; and when the disease has prevailed, the poison may be left behind in a dormant state from being simply dry, so that seeds of a new

outbreak may exist in the soil co-extensive with the first. Hence the imprudence of encamping on old encamping grounds (to which have so often referred); and, in short, these views of Dr. Budd appear to explain, in the most natural way, almost all the leading facts which characterize the diffusion of the pestilence. They explain especially the relation of cholera to filthy habits and defective drainage—its predominance in low levels—its striking tendency to follow the natural line of water-shed—its communication to persons who not only have never been in the presence of the sick, but who are stationed at a distance from them—contamination of those only who visited one particular or single privy, into which the rice-water evacuations had been discharged from the first casual case—and the operation of tainted privies in propagating the disease in workhouses, barracks, prisons, and places of public resort. (Dr. Budd's Letters addressed to the *Association Med. Journal* in 1854-55; Dr. L. Lindsay's able papers; and Dr. Alison's paper "On the Communication of Cholera by Dejections," in *Edin. Med. Journal*, 1855.

Nevertheless, there can be no doubt, as already stated, that under circumstances of great concentration, or otherwise, some unknown poison is communicated probably by *fomites*, through human intercourse; and as emanations, of some kind or other, passing through the air, they act as poisons on the gastropulmonary mucous membrane of susceptible persons. Dr. Parkes has shown, in his Indian experience of cholera, that it may pass with extreme slowness against the wind (even the trade or monsoon wind), which only retards its course, and that a favourable wind promotes its transmission; and that it sometimes travels in this way, and not by the shortest route of human intercourse, or even by the route of greatest intercourse between places.

Predisposing Causes of Cholera.—The influence of these is chiefly apparent in the age and sex, food, fatigue, filth, misery, and intemperance of the people.

Both sexes and all ages, including new-born children, are liable to the disease. Dr. Farr's results show that males suffered more than females at all ages under twenty-five years, but between twenty-five and forty-five the females suffered more than the males. The deaths from cholera in Paris were estimated at 18,402 in 1832; and it was remarked that the mortality was least from six years to twenty, greater from thirty to forty, and

greatest of all in old age. The influence of *sex* in predisposing to cholera can hardly be said to be determined; for in Calcutta, of the native inhabitants attacked with cholera, the males were to the females as four to one, while in Bombay the proportion was as seven to twenty-five. In Canada the soldiers' wives were observed to suffer nearly in an equal proportion with their husbands; and this was the case among the civil inhabitants of Gibraltar.

In all countries the *lower classes* have always suffered in a much greater proportion than the upper classes. In Calcutta the disease ran a wide career of destruction in the native town, while the "City of Palaces," inhabited by the English, was much less affected in proportion to their numbers, and the same disproportion has been observed in Bombay. In general, it has been observed among the native inhabitants of India, that the Brahmin and Banian merchant suffered less than the Ryot or farmer, while the poor outcast Pariah suffered the most of all. In every town in Europe it has been observed that the lower classes, and especially those resident on the banks of rivers, have suffered infinitely more than the upper classes.

In military life it has been supposed that the Sepoy suffered more than the European soldier living in India. This, perhaps, is true in some instances; but the returns of the Madras army show this not to have been the fact in that Presidency; for the European soldiers attacked appear to have been as one to three, while of the Sepoy force it was only one in four and a-half. In the Indian army, also, it appears to have been universally observed that the officer suffered in a less proportion than the soldier, the cavalry than the infantry, and the infantry less than the hard-labouring, ill-fed camp-follower.* The troops on march likewise

* The Madras Sepoy, of whom alone Dr. Balfour wrote, invariably carries his family with him. At the end of a long march he puts off his accoutrements, and hastens back, without tasting food, to assist his family out of the difficulties incident to a country in which the roads are often mere tracks. He thus often performs nearly double the route march, and finally encamps on ground which for years has been used for the purpose, and is saturated with the excretion of former sufferers from the disease. Moreover, for a long time the authorities in Southern India were most reckless in sending regiment after regiment in one another's footsteps, through districts known to be infected; and as they all occupied the same encamping ground, the last regiments pitched in places saturated with cholera evacuations, and surrounded by the half-buried remains of the dead. These facts to some extent explain the effects of marching on Sepoys (W. C. MACLEAN).

universally suffered more than the troops in quarters; and this influence of long marches appears to indicate something more powerful than mere fatigue in bringing about the disease. Dr. Balfour has proved that of the native soldiers of the Madras army thirty-two died of cholera in cantonment, and eighty-six when marching, to an average of 10,000 strength; the number attacked being respectively 85 and 200 in 10,000. Dr. Lorimer's reports show that the men were more frequently attacked on long than on short marches, the men (as Dr. Farr observes) being longer exposed to the causes of disease. These causes are those, as Sir Ranald Martin observes, which are incidental to the life of a soldier on the march, such as lying by the banks of rivers, on low marshes, jungly grounds, sleeping on the ground, and, I may add, encamping amongst the filth of encampments recently occupied, but abandoned, of which indiscretion there were many melancholy examples during the war with Russia in 1854; for example, the occupation of the evacuated camping ground at Aladyn in Bulgaria, and that on the heights above Alma, previously occupied by the Russians, the consequences of which were so fatal to the first and fourth divisions of our army.

The effects of a poor diet in predisposing to cholera will perhaps be better understood by stating that the European suffers less than the Mahomedan, and the Mahomedan, who is better fed and better clothed, than the Hindoo, except during their rigid fasts, when the Mahomedans suffer in a much larger ratio. During the epidemic of 1848 and 1849, in Edinburgh, Dr. William Robertson of that city found that anæmic persons were those most predisposed to cholera.

Susceptibility to Cholera.—The actual number of persons attacked out of any given population appears to have varied very greatly. Mr. Scott has stated, that in the marching corps it has varied from 17 to 330 per corps of about 1,000 men; and in no instance, even in all the wretchedness of the Indian towns, has the community suffered to the whole extent of the population. In Europe, Moreau de Ionnes has given the following estimate as an approximation to the probable numbers attacked in this part of the world:—In France, 1 in 300; Russia, 1 in 20; Austria, 1 in 30; Poland, 1 in 32; Prussia, 1 in 100; Belgium, 1 in 120; Great Britain and Ireland, 1 in 131; Holland, 1 in 144; Germany, 1 in 700. The circumstance of one attack by no means armed the

constitution against a second in the same or any subsequent year; still a repetition of the disease in the same person in the same year was rare.

Diagnosis.—The phenomena of the first stage of cholera are so unlike those of any other disease that they cannot be mistaken. The second, or febrile stage, is similar to typhoid fever, and is not to be distinguished from it, except by the previous history and phenomena. The cholera Indica differs from the cholera morbus of Sydenham in the lividity of the extremities, in the more rapid loss of the pulse, in the greater amount of collapse, in the duration of the fatal cases, half of which in this country have terminated within twenty-four hours of the first appearance of decisive symptoms, while half of the cases of common cholera (morbus of Sydenham) terminated *in three days*, and half the cases of diarrhœa or cholerine extended over *six days*.

The cholera as seen in India differs from that of Europe, according to Drs. Barry and Russell, in the evacuations of the former being more profuse and ungovernable, and again, from the patient becoming much more frequently convalescent, without passing through the febrile stage.

Prognosis.—The mortality from cholera in all countries is very great. Taking the whole number attacked, it is said that the number of deaths in Astrakan were as one to three; in that of Mishni Novogorod as one to two; in Moscow and Casan as three to five; and in Penza, in the country of the Don Cossacks, as two to three. In the summer of 1831, the mortality at Riga, St. Petersburg, Mittau, Limburg, and Brody, according to the *Berlin Gazette*, was about one-half, while at Dantzic, Elbing, and Posen, it was about two-thirds of the whole number attacked. The period of the epidemic, however, greatly influenced the mortality; for, on the first onset, nine-tenths of all those attacked perished, then seven-eighths; and the proportion of deaths forms a gradually decreasing series of five-sixths, three-fourths, one-half, one-third, till, towards the close, a large proportion of those attacked recovered. The uniformity of this law in every country affected with cholera, whether Europe, America, India, or China, is extremely remarkable.

The chances of recovery are much diminished in young children and in the aged; the age of greatest number of recoveries being

from fifteen to twenty. The feeble in constitution, the sick, the convalescent were in all cases the surest victims of cholera. But whatever the age of the patient, Gendrin states he lost every case which became pulseless.

Treatment.—There are few diseases for the cure of which many different remedies and modes of treatment have been employed as in cholera, and unfortunately without our discovering an antidote to the poison. In Moscow, it is said that two different modes of treatment were practised at different hospitals and that the proportionate number of deaths was the same in both. In the same city it is supposed that the mortality was greater among those destitute of medical aid than among those who had every care and attention shown them. It may be fairly inferred, therefore, that in the severer forms of the disease the action of this poison is so potent as to render the constitution insensible to the influence of our most powerful remedial agents. When, however, the disease is mild, or on the decline, much may be done, by obviating symptoms, to promote the recovery of the patient.

The heroic remedies that have been employed in cholera are bleeding, and calomel, and opium, either separately or conjointly. With respect to bleeding, it may be stated, that in every country the patients bore bleeding badly in any stage, and that the practice in Europe was at length limited to a few leeches occasionally to the head. As to calomel, that medicine was used to the greater part of an ounce in the twenty-four hours, but with little success as an antidote, that many patients have been seized and have died under the full influence of mercury. On the appearance of cholera in Europe, opium was administered in the doses recommended by the Indian practitioners, to the great part even of an ounce of laudanum; but it was soon seen that, in the cold stage, it was inefficient in controlling the vomiting and purging; that it did not allay the spasms, and, moreover, hardly produced any narcotic effect. The action of the accumulated doses of opium, however, though suspended during the cold stage, was often fully developed in the hot stage, and occasioned much affection of the head that most practitioners either abandoned its use, or limited it to a mere fractional dose of that usually given in India—namely, from *three to twelve minims*

the tincture of opium, or half a grain to a grain of solid opium every four or six hours.*

Another heroic plan, peculiar perhaps to this country, and which was practised when the inefficiency of medicines was generally admitted, was an injection of a solution of half an ounce of muriate of soda, and of four scruples of sesquicarbonate of soda, in ten pints of water, of a temperature varying from 105° to 120° Fahr., into the veins of the suffering patient. This solution was injected slowly, half an hour being spent in the gradual introduction of the ten pints, and the immediate effects of this treatment were very striking. The good effects were rapid in proportion to the heat of the solution, but a higher temperature than what is stated could not be borne. After the introduction of a few ounces, the pulse, which had ceased to be felt at the wrist, became perceptible, and the heat of the body returned. By the time three or four pints had been injected, the pulse was good, the cramps had ceased, the body, that could not be heated, had become warm,

* Concerning the treatment of cholera, Professor Maclean writes me as follows:—

“Opium in cholera should be given only in the premonitory diarrhoea. At this stage, in combination with a stimulant, it is often of the highest value. If persevered in, particularly in the strong doses justly reprobated in the text, it is a dangerous remedy, inducing fatal narcotism, or, at the least, interfering with the functions of the kidneys, and so leading directly to uræmic poisoning.

“Urgent thirst is one of the most distressing symptoms in cholera: there is incessant craving for cold water,—doubtless instinctive, to correct the inspissated condition of the blood, due to the rapid escape of the *liquor sanguinis*. It was formerly the practice to withhold water—a practice as cruel as it is mischievous. Water in abundance, pure and cold, should be given to the patient, and he should be encouraged to drink it, even should a large portion of it be rejected by the stomach; and when the purging has ceased, some may, with much advantage, be thrown into the bowel from time to time.

“In the stage of re-action the fever may be moderated by cold sponging, or by the wet sheet; the secretion of urine may be promoted by dry cupping over the loins, by the use of the chlorate of potash, and the like. But suppression of this secretion is most to be dreaded where opium has been too freely used in the treatment. In men of intemperate habits we often see, during the stage of re-action, obstinate vomiting of thick, tenacious, green paint-looking matter, probably bile pigment, acted on by some acid in the stomach or alimentary canal. It is a symptom of evil omen, and often goes on uncontrolled until the patient dies exhausted, and this although all other symptoms may promise a favourable issue. I have known it last for a week, resisting all remedies, and proving fatal when the urinary secretion had been restored, and all cerebral symptoms had subsided. Alkalies in the effervescing form, free stimulation of the surface, and chloroform in small doses, offer the best hope of relief. The patient should be nourished more by the bowel than the stomach when this symptom is present.”

and instead of a cold exudation on the surface, there was a general moisture; the voice, before hoarse and almost extinct, was now natural; the hollowness of the eye, the shrunken state of the features, the leaden hue of the face and body, had disappeared, the expression had become animated, the mind cheerful, the restlessness and uneasy feelings had vanished, the vertigo and noises of the ear, the sense of oppression at the præcordia had given way to comfortable feelings; the thirst, however urgent before the operation, was assuaged, and the secretion of urine restored, though by no means constantly so. But these promising appearances were not lasting; the vomiting continued, the evacuations became even more profuse, and the patient soon relapsed into his former state, from which he might again be roused by a repetition of the injection; but the amendment was transient, and the fatal period not long deferred. Of 156 patients thus treated at Drummond Street Hospital, Edinburgh, under the direction of Dr. Mackintosh, only twenty-five recovered,—a lamentably small proportion, and small as it is, it seems doubtful if the recoveries were final or complete. (Mackintosh, *Principles of Pathology*, p. 365.)

The great want of success that has attended these heroic methods has caused every substance at any time known in the pharmacopœia to be tried as an antidote. Every metal, from arsenic to platina, has been given; also every vegetable and mineral acid; the various alkalies, and most of the neutral salts; phosphorus; strychnine and quina; hæmatoxylon, kino, and every known vegetable astringent; hydrocyanic acid; the entire class of narcotics; the large class of essential oils, balsams, turpentine, and spices, and most tonic medicines; and when these failed, the patient has been made to respire oxygen, or nitrous oxide gas; and with a view of imparting new powers to the sinking frame, transfusion of blood has not unfrequently been performed; but all these means have been more or less unsuccessful.

The failure of all these powerful means at length caused most practitioners to confine themselves to checking the diarrhœa which so frequently precedes cholera, and lays the foundation of the future attack, and subsequently to obviating symptoms. For this purpose moderate doses of opium or morphine, either alone or combined with stimulants, as the *confectio opiata*, or the *pulvis cretæ compositus cum opio*, were often sufficient. In more obstinate cases some vegetable astringent was added, as the

tincture of kino, or the *decoctum hæmatoxyli*, and these remedies frequently prevented the attack altogether. If, however, the disease proceeded, and the cold stage of cholera formed, the same remedies were prescribed, moderate in quantity, and often out of an effervescing draught. But to promote re-action in cholera and diarrhoea, the following *formula* has met with most universal approval in this country and in India. So highly is it valued, indeed, that it is ordered to be always in store, and in readiness in the "*Medical Field Companion*" of the army when on the march:—

R. Ol. Anisi.; Ol. Cajeput; Ol. Juniper, a a ʒss.; Ether, ʒss.; Liquor Acid. Halleri, ʒss. ;* Tint. Cinnam., ʒ ff.; *misce.* *The dose of this mixture is ten drops every quarter of an hour in a table-spoonful of water. An opiate may be given with the first and second dose, but should not be continued, for reasons already given.*

Heat may now be applied, and the patient wrapped up in warm blankets and hot bottles, or bags of heated sand placed around his cold and benumbed body. The warm bath was at first tried, but discontinued from the uncontrollable nature of the vomiting and purging, and the oppressive heat it produced to the patient's feelings. Mr. Dalton's vapour bath has been used, but without benefit, and to the disappointment of the hopes which had been entertained of it. Other methods of restoring warmth were had recourse to, such as frictions with the hand, or by the flesh-brush, or rubbing the body with some stimulant embrocation, compounded of garlic, capsicum, camphor, cantharides, or other powerful irritants. Mustard poultices also were often applied to the feet and abdomen, blisters with or without an addition of oil of turpentine, the part having been previously rubbed with hot sand; and in cases supposed to be more urgent, the mineral acids, and even boiling water, were employed for the purpose of producing instant vesication. And again, we read of those who have tried to stimulate the waning powers of life by galvanism, acupuncture of the heart, issues, setons, moxas, actual cautery along the spine, and lastly, by small pieces of linen dipped in alcohol, distributed over the body, and then set fire to!

In a few instances these efforts were rewarded with success,

* The *Liquor* or *Elizir Halleri* consists of one part of concentrated *Sulphuric Acid* to three parts of *Rectified Spirit*. It is commonly employed in Germany in the treatment of typhus and allied diseases, in doses of five to twenty drops in solution (MURCHISON, l. c., p. 266).

re-action and the second or febrile stage being formed. It is this period of the disease that some physicians think calomel should be given in moderate doses, for the purpose of producing flow of bile into the intestines, and of emulging the gall-bladder and ducts, as well as of restoring the other suppressed secretions. The indications, however, more generally followed, were to imitate the case as we should a similar state in typhoid fever—namely, to moderate the affections of the bowels by mild opiates, by enemata, and by sinapisms to the abdomen; also, to relieve the head by leeches and cold lotions, and subsequently, as the tongue became brown, to support the patient with wine, sago, strong broths, and a generally cordial treatment.

When medical men have charge of large numbers of people in the army, navy, prisons, workhouses, asylums, hospitals, and the like, it is incumbent on them to make frequent inspections of those under their care, and to seek out any cases of incipient diarrhoea. Responsible officers should be made to take notice of those who go more than once a-day to the water-closets, at times when the cholera epidemic influence prevails. "In military practice," as Dr. Maclean justly observes (MS. notes to the author), "frequent inspection of the men is of cardinal importance. Every man in a regiment should be seen at least three times a-day by some medical officer, who should also visit the various guard-houses. By walking down the ranks at roll-call, and picking out the men who show the earliest symptoms, cases are thus caught in the stage of premonitory diarrhoea and saved."

CHAPTER VI.

PATHOLOGY OF THE ENTHETIC ORDER OF ZYMOTIC DISEASES

THE diseases which belong to this order have the common property of becoming developed in the system after the introduction by inoculation or implantation of specific poisons. The sources of such poisons are more distinctly traceable than those which produce the miasmatic diseases; in other words, the substance or material which contains the *poisonous principle* can be obtained

in most instances, although the *principle* itself has not been isolated by any chemical process. The poisons which produce the diseases of this order may be introduced through thin or abraded cutaneous surfaces, or through mucous membranes by the process of absorption, although, in most instances, it is believed that some solution of continuity exists. Others are directly introduced by weapons which inflict a wound or abrasion, and which at the same time introduce the poison. In all instances the poison is received into the system by the processes of absorption, and the individual thus becomes inoculated. Thus, germs of a *specific* kind become directly implanted, and by a zymotic-like process become developed and increased in quantity or virulence till symptoms and effects are produced characteristic of the specific affections, and hence the name given to this order of diseases. No one has better illustrated the pathology of these diseases than Mr. Paget, from whose lectures *On Surgical Pathology* the following statement is given:—

When a morbid poison is inoculated it produces a specific effect, both on the tissue at the place of insertion and on the blood, as soon as the poison, or any part of it, is absorbed: in other words, it produces both a constitutional and a local change; and in both these effects its history must be traced. The specific local change is best seen in, and most rapidly follows the implanting of certain animal poisons, such as those of venomous serpents and insects. The consequences of the insertion of such poisons are peculiar, and constant in their peculiarities. The bite of a bug, for example, is followed, within less than a minute, by itching in the bitten part, and very soon a wheal, or circumscribed pale swelling, with a nearly level surface and a circumscribed border, gradually rises and extends in the skin. The swelling is produced by œdema of a small portion of the cutis at and round the bite. As the itching subsides, the pale swelling becomes less defined, and the more general vascular swelling of the surrounding and adjacent tissues gradually encroaches on the primary swelling at the bitten spot. In about twenty-four hours a papule or some form of secondary inflammation appears, with renewed itching at the site of the puncture. This, too, in the case of the bug-bite, gradually subsides. The primary swelling here described illustrates the immediate effects of the morbid poison on the tissue at and round the seat of inoculation; and within the area of such a swelling the

tissues are, by the direct contact or influence of the venom, altered in their nutritive relation to the blood. Such specific alterations of the tissues at the seat of inoculation occurs with the syphilitic, the vaccine, and such-like virus; but the direct influence is most rapidly shown in the effects of the bites of the viper, the rattlesnake, and the cobra de capello. In such cases, sloughing of the areolar tissue is established immediately after the bite. The poison seems to operate at once on the tissue, neither in the direction of the nerves, nor of the absorbents, nor of the blood-vessels; but the slough forms at the puncture, as if the venom had completely and at once killed the tissue (BRODIE, PAGET).

A secondary inflammation soon appears at the bitten or punctured part; and the occurrence of this new inflammation may be ascribed in some measure to an influence exercised by the virus on the blood; and it proves that the part does not return to health although the first effects of the inoculation may subside. It proves that some material of the virus remains, or that the effects it has already produced upon the tissues at the injured part alter their relations to the blood, and render the part prone to specific disease. These specific effects upon the part may remain locally quiescent for a considerable length of time—during all that period of latency or incubation which intervenes between the inoculation and the appearance of the specific disease. But during all this interval—during all this period of incubation—the tissues at the site of inoculation are constantly changing; and the virus itself, like all organic matter, is probably in constant process of transformation till the *zymosis* is complete, and the specific disease is fully developed and expressed by various constitutional phenomena.

The changes which the absorbed virus undergoes in the living and infected body are,—(1.) Increase; (2.) Transformation; (3.) Combination; and (4.) Separation or excretion. The increase of the virus is shown in such inoculable diseases as vaccinia, glanders, malignant pustule, syphilis. In all of these diseases the inoculation of the minutest portion of virus is followed by the formation of one or more vesicular structures containing fluid from which virus, similarly and equally potent, is produced in million-fold quantity. Thus the virus of any contagious disease developed in an infected person may render his exhalations capable of similarly affecting thousands of other people. And, it is probably

among azotized materials chiefly that morbid poisons, whether of animal origin or of disease, find the means of their increase (CARPENTER, PAGET, SIMON).

The *transformation* of the virus is indicated by the successive phenomena which supervene during the continuous course of a specific disease. For example, syphilis is followed by a series of secondary and tertiary phenomena, which follow, on the whole, a uniform course in a great variety of patients; so that these regular syphilitic phenomena may be attributed to the *transformations* of the morbid poison; while the irregularities of the phenomena may be ascribed to constitutional peculiarities of the patient, either natural or acquired from treatment. Thus there are periods of incubation, of development, of maturity, and of degeneration in the material of the virus; and the various phenomena which constitute the *symptoms* and *prodromata* of the disease correspond to such periods of transformation; while the increasing disturbance of the general health probably implies that the morbid poison is increasing while it is being transformed—that it grows or multiplies with its development.

The *combination* of a morbid poison with some normal material of the blood is indicated by the circumstance, that when the same specific disease, produced by the inoculation of the same matter, affects many persons, the disease set up in each of them may present different peculiar features. The disease may have some peculiar and varied methods of expressing its development in different persons—“*personal peculiarities*,” as Mr. Paget calls them, and which he considers due in some measure to the combination of the virus with one or more of those normal materials of the blood which have in each person a peculiar or personal character. By such combinations the following characters of specific diseases may be explained, namely,—(1.) Changes in the disease by transmission from one person to another; (2.) Some varieties of syphilitic sores, and varieties of their consequences in different persons inoculated from the same source; (3.) The change in the forms of secondary syphilis in transmission from parent to offspring.

The *separation* or *excretion* of the virus may be accomplished in many different ways, and may be regarded as the final purpose of the morbid process. It is evident in the inoculable products of some vesicles and pustules.

In all of these *enthetic* diseases the immediate or the ultimate effect of the poison is to induce deterioration of the blood, and at the same time the poison seems to multiply itself, or to increase in power by some mode not quite well understood, and which has been likened to the *zymotic* action which is known to take place in fermentation. The process by which the poison is multiplied, or by which its virulence or strength is increased, varies much as to the time required for its completion.

Some of the more intense and virulent poisons, such as that of the most venomous serpents, produce their deleterious and perhaps fatal effects in as short a time as it takes the blood to complete a circulation. The change in the blood at once commences, and death rapidly follows. This sometimes happens with some forms of the *cadaveric poison*, as that which results from wounds received in the dissection of virulent cases of puerperal fever.

Other poisons do not exert their pernicious influence till after a tardy process of incubation, the time of which is not constant, as in *hydrophobia*.

In a third class of poisons which produce diseases belonging to this order, a double process of the zymotic-like action seems to take place before the full effects which the poison is capable of producing are completed. The syphilitic poison is an example of this. The multiplication of this venereal poison, and its effects upon the system, seem to become developed during the existence of the hardening process which surrounds the *infecting* venereal sore.

This is the first zymotic-like process, and is attended with a local papule and perhaps an ulcer. From this local sore the system becomes contaminated; and in the blood a second process of zymosis appears to be completed, by which the original poison becomes intensified, its pernicious influence more complete, and its specific secondary and tertiary effects are then fully developed.

Many of the diseases implanted by specific poisons claim the attention rather of the surgeon than the physician, and therefore they may be considered as not properly coming within the scope of this handbook of medicine. But for the sake of the pathological doctrines they illustrate; also, because of the importance of their effects upon the system, and in relation to other diseases, some of them will be considered here.

CHAPTER VII.

DETAILED DESCRIPTION OF THE ENTHETIC ORDER OF ZYMOTIC DISEASES.

HYDROPHOBIA—*Rabies*.

Definition.—*A disease said to be generated spontaneously or sporadically in animals of the canine or feline race, the specific poison of which, being implanted by them in man, or in other animals, produces a similar malady. The saliva or secretion issuing from the mouth of the diseased or rabid animal conveys the poison which inoculates rabies, either through a wound or through a thin epidermis without abrasion. The period of incubation of the poison after inoculation varies from four to sixteen weeks, or even longer, before the malady becomes developed. The disease is characterized by severe constriction about the throat, spasmodic action of the diaphragm, and distress at the epigastrium; all of which are aggravated or brought about by attempts to take fluid, or by the least breath or current of air on the surface of the body, which produces, in the first instance, an effect resembling that produced upon stepping into a cold bath. Tenacious and clammy saliva issues from the mouth. Paroxysms of phrenzy or of uncontrollable impulsive violence (rabidity) supervene. The duration of the disease varies from three to six or seven days, the greater number of cases terminating in death on the second and fourth days from the accession of symptoms. Death is generally sudden, and often unexpected.*

Pathology and Symptoms.—The saliva of the dog or other animal labouring under rabies is either the virus, or contains (as any menstruum would) the poisonous principle, which by inoculation produces *hydrophobia* in the human body. The disease is so named, not because there is any dread of water, but because in man the most prominent symptom is an inability to swallow, or to attempt to swallow, any fluid, on account of the extreme spasms which the attempt produces. The experiments of Hartwig have proved that the poison is of a definite character, that it may impregnate various substances, and that it retains its activity for a long period.

Two points in the pathology of *rabies* are peculiar, namely—*first*, that a long period of latency exists in the human subject; and *second*, that inoculation is not always followed by the development of the specific disease.

With regard to the first of these peculiarities, it is to be noticed that, although in some cases pain has been felt in the cicatrix a considerable time after the accident, and in a few a slight fever or a rapid pulse has been remarked to continue from the receipt of the injury to the outbreak of the malady, still the symptoms of the disease in man seldom show themselves sooner than the *fortieth* day after inoculation, and rarely after two years. A matured zymosis seems essential to the production of the full influence of the poison, and it may be that a double zymosis takes place, as in the case of the venereal virus, first in the part and afterwards in the system (MILLER), the result of which is either to multiply the poison or to increase its virulence.

Undoubted instances are, however, on record in which the characteristic symptoms appeared as early as the *twelfth* day (SIDEY), and on the *eighth* day (TROILLIET), who even quotes instances of their occurrence as early as the day following the injury. The duration of the period of incubation, however, is sometimes of extreme duration. It has been satisfactorily proved to extend over five and a-half, six, or even nine months (BERGERON, BRANDRETH); and there is on record a large body of evidence in favour of the opinion that the incubation stage of hydrophobia may be prolonged not only over a series of months, but also of one year at least. An analysis of sixty authentic observations by Romberg has shown that the shortest interval between the introduction of the poison and the appearance of the disease is fifteen days, the longest from seven to nine months, and that the average period is from four to seven weeks. The inquiries of Drs. Hamilton and Hunter give to the majority of cases a period of incubation from *thirty* to *fifty-nine* days. In the *Transactions of the Vienna Medical Association* a case is recorded of a period of incubation extending over two years (HASSINGER); but this is discredited both by the elder and younger Gurlt, of Berlin, whose experience in veterinary pathology has been very extensive. In all such extremely long cases the question may be asked, whether the disease has been actually inoculated at a period so far back, or has there occurred a

re-inoculation at some intervening period? It is known that the dog in the early stage of the disease has a disposition to lick the hands, face, &c., of persons, and especially of those with whom it is familiar; and there are cases on record where the disease has been implanted in this way. Mr. Lawrence mentions the following:—"A lady had a French poodle, of which she was very fond, and which she was in the habit of allowing to lick her face. She had a small pimple on her chin, of which she had rubbed off the top; and, allowing the dog to indulge in his usual caresses, he licked this pimple, of which the surface was exposed. Thus she acquired hydrophobia, of which she died." While this example teaches us that hydrophobia may be implanted without a bite being inflicted, in this almost unconscious manner, it ought to deter people from permitting such dangerous indulgence to a dog. The greatest anxiety and misery have frequently been experienced for many months, by those who have been thus imprudent, owing to the circumstance of rabies having subsequently appeared in the animal so indulged (COPLAND). There are instances, however, recorded of very long periods of incubation after a bite, where subsequent inoculation, independent of a bite, could not have taken place. For example, there is a case published by Mr. Hale Thompson in vol. i. of the *Lancet*. The subject of it, a lad, aged eighteen, had been twenty-five months in close confinement in prison, and during that time had never been exposed to the bite of any animal. He had been bitten severely by a dog seven years before in the right hip, and the scar still remained. During the whole period he was under observation he was sullen, gloomy, and reserved, and was never known to look the person in the face to whom he spoke. Death occurred after a three days' illness, during which "the most decided symptoms of hydrophobia were manifested."

On the 15th of May, 1854, a case was admitted into Guy's Hospital under the care of Dr. Hughes, in which hydrophobia appeared to have been developed five years after the bite. (*Med. Times*, 1854). Such observations render it extremely probable that the period of incubation of the specific poison of hydrophobia is indefinite; and the circumstances which, in man especially, seem to shorten the duration of this period, or prolong it, are in a great measure quite unknown. There are some other circumstances which seem to show that during the long interval

of apparent latency the quantity or the virulence of the implanted poison seems to increase, locally at least, if not also more extensively in the system.

First, In some instances there are evidences of a slow and silent change going on in the constitution, indicated by sallow looks, sunken eyes, a pulse somewhat accelerated, more easily excited and weaker, combined with symptoms of general debility (COPLAND).

Second, The observations of Dr. Marochetti, who visited the Ukraine in 1820, and who maintained that in that country characteristic pustules were observed to form beneath the tongue, near the orifices of the submaxillary glands, between the third and ninth day after the infliction of the bite. This observation was confirmed by M. Magistel, at Boulay, in France, in 1822, who noticed that the pustules formed from the *sixth* till the *thirty-second* day. He observed two forms of pustules, a crystalline and an opaque, the latter of which, when opened, left a small ulcerated cavity. They were situated on the sides of the *frænum linguæ*, and on the lateral parts of the inferior surface of the tongue.

Third, Changes which take place in the *cicatrix* before the development of characteristic symptoms indicate that the implanted poison there undergoes some process, the nature of which is as yet not known.

After the local incubation of the poison is complete, its specific action appears to be exercised upon the *medulla oblongata* and the *eighth pair of nerves*, and subsequently lesions of the structures supplied by the branches of the *eighth pair*. The action of the poison appears, in the first instance, to be made distinctly manifest by the œsophageal branch of the *eighth pair*, producing that derangement of function which gives rise to the characteristic symptom of the disease, or to the extreme difficulty of swallowing, especially of fluids; while the spasmodic catching of the breath, consequent even on touching the lips with any liquid, proves that the recurrent nerve is equally affected. Subsequently, the eye and ear become distressed by every ray of light or impulse of sound, and likewise the sense of touch is most painfully excited on the slightest breath of air passing over the surface of the body, all of which distinctly show that the central and spinal nerves must be functionally affected. In a still more

advanced stage the suspicion, the irritability, the violence, and, generally, the outrageous and uncontrollable derangement of mind which often seizes the patient, bringing on epilepsy and convulsions, show that the brain itself is likewise a principal seat of the action of this terrible poison, especially the region of the *medulla oblongata*. The effects of the hydrophobic poison are often so violent in the first instance as to cause the early death of the patient; and the bodies of many persons having been examined who had so died, not a trace of inflammation or other morbid phenomena were discovered. More commonly, however, some structural alterations have been found, limited to slight inflammation of the brain, the spinal cord, or of their membranes, and of the lungs, stomach, or structures supplied by the *eighth pair* of nerves. Still, the brain, the lungs, or the stomach, may be either separately or conjointly affected—phenomena in no degree dissimilar to what have been observed in whooping-cough, where the poison seems to act chiefly on the vagus nerve.

It is doubtful, however, whether the actions of the poison end here, for in a case related by Majendie, and whose existence was prolonged beyond the usual period, suppuration of the synovial membranes of the joints took place, and produced a state of suffering remarkable even in this frightful disease, and far more terrible than death itself. The organic lesions which have been found after death in cases of hydrophobia are as follows:—

When the membranes of the brain have been found diseased, the appearances have been, great congestion, especially of the *plexus choroides*, also effusion of serum, sometimes muddy, into the arachnoid cavity, and into the ventricles. In an interesting case recorded by Dr. R. W. Cunningham, of Her Majesty's 4th Bengal Europeans, the layers of the arachnoid were found adherent in many places, especially along both sides of the longitudinal sinus. The adhesions were quite soft and recent, and flakes of coagulated fibrine floated in the fluid. The brain has, in some very few cases, been supposed to be harder or softer than usual, and to have more bloody points than in health. There has been no lesion noticed, however, that could be directly connected with the malady. Changes in the *medulla oblongata* and the *spinal cord* have not yet received sufficient attention. In the case just referred to, related by Dr. Cunningham, there was a reddish spot in the substance of the *pons varolii*, having the appearance of

inflammatory softening. On the lower surface of the *medulla oblongata*, at the origin of the *seventh, eighth, and ninth pair of nerves*, the membranes were highly vascular, thickened, softened, and matted together; but the substance of the nerves at their exit, and of the *medulla*, seemed normal. There are strong reasons for believing that changes actually exist in these parts, which escape the detection of our unaided senses, but which the specific gravity test, combined with microscopic examination, may yet demonstrate. The mucous membrane of the pharynx and œsophagus have been met with, either greatly congested or diffusely inflamed, as also that of the stomach, and of the trachea and bronchia. The latter have been found covered with a considerable quantity of frothy mucus, while the pulmonary tissue has shown marks of inflammation, though more commonly only of great congestion. The salivary glands have likewise occasionally been observed increased in size, and vascular. In a case of hydrophobia which I had an opportunity of dissecting at Renfrew, near Glasgow, the most prominent morbid change was visible in the greatly increased vascularity of the lungs, and of the mucous membrane of the back part of the mouth, pharynx, and larynx, as far as the vocal chords. The whole of these parts were covered by a tenacious frothy mucus, tinged with blood. The glands surrounding the papillæ over the back part of the tongue were very much enlarged, not unlike what I have observed in severe cases of cholera. So also were the submucous glands of the pharynx, the epiglottis, and the larynx, even in its cavity, and of those beneath the tongue. Inflammatory appearances in these parts have been observed by Morgagni, Babington, Watt, Portal, Troiliet, Copland, and others.

Symptoms.—The wound inflicted by the bite, whether neglected or dressed, generally heals up kindly, leaving a cicatrix, and for a time the patient usually suffers no other derangement of health than the depression of spirits which his apprehensions are calculated to excite. A few weeks or a few months having elapsed, the latency of the poison terminates, and the disease is formed. The course of the affection is usually divided into three stages; the first stage comprising the symptoms which precede the difficulty of swallowing; the second commences with the difficulty of swallowing, and terminates with the overthrow of the mind; the last stage embraces all the concluding phenomena.

The first stage commences in a few instances by the patient's attention being aroused by a numbness extending towards the sensorium from the injured part (which, if an extremity, may become tremulous); or pain is felt in the cicatrix, sometimes severe and sometimes trifling, and which shoots up the bitten limb, following in general the course of the nerve towards the trunk. It shoots as if towards the heart, and there is no evidence of lymphatic absorption. Pain, however, is by no means constant, and is for the most part absent. In the latter case, the first symptom is chilliness, with headache, or a slight attack of fever, and the patient is more excited or depressed than usual. These premonitory warnings last but a few hours, or at most a few days; when the fatal but characteristic symptom, "the difficulty and dread of swallowing"—a symptom which distinguishes this malady from all others—appears, and the hydrophobic stage commences.

The second or hydrophobic stage is ushered in with a great difficulty, if not an utter impossibility, of swallowing any liquid—a symptom which generally comes on suddenly; and such horrible sensations accompany the effort, that whatever afterwards even recalls the idea of a fluid excites violent agitation and aversion. Some patients who have been able to give some account of themselves, describe the hydrophobic sensation as a rising of the stomach, which obstructs the passage; others as a feeling of suffocation, or a sense of choking, which renders every attempt to pass liquids over the root of the tongue not only impossible, but which excites convulsive action in the muscles of the larynx, pharynx, and abdomen. In this state, says Dr. John Hunter, "the patient finds some relief from running or walking, which shows that the lungs are not yet the seat of any great oppression."

The hydrophobia, or inability to swallow fluids, is shortly accompanied by an increased flow of saliva, termed the "hydrophobic slaver." This secretion, as the disease advances, is not only copious but viscid, so that it adheres to the throat, and causes incessant spitting, and the quantity expectorated may be taken as the measure of the violence of the disease. By some this increased flow of saliva is considered as an effort of the system to eliminate the poison through these excretory glands; and, therefore, mercury in large doses, to promote salivation, has been recommended to promote elimination in this way, and

to reduce the extreme excitability of the nervous system (LIGGET).

The aversion to fluids is no sooner established than another series of symptoms of dreadful severity, or a highly exalted state of every corporeal sense, is added. Indeed, it is hardly possible to depict the sufferings of the patient from this cause; for not only does he shrink at the slightest breath that blows over him, but the passage of a fly, the motion of the bed-curtain, or any attempt to touch him, produces indescribable agony, almost amounting to convulsions. Dr. Elliotson states that the effect produced by these causes very much resembles that produced upon stepping into a cold bath. The sense of sight is no less a source of terror than that of touch, for the approach of a candle, the reflection from a mirror or other polished surface, occasions the same distressing effect. The hearing is as strongly affected as the other senses, so that the least noise, and especially that of pouring out fluids, throws him into a fearful paroxysm. An attendant who sat up with a hydrophobic boy, made water within his hearing, which threw the sufferer into a most violent agitation. The degree to which this painful state of the senses arrives may be understood when it is stated that Majendie records the case of a deaf and dumb child, who heard distinctly in this stage of the disease. The patient, thus incessantly harassed and pained by every circumstance around him, becomes peevish and irritable, and at length sees his family, relations, and strangers, with feelings of dislike and aversion, and sometimes apparently with horror.

The third stage commences by the cerebral functions becoming disturbed, the mind being either filled with dreadful apprehensions, or being so completely overthrown that paroxysms of uncontrollable impulsive violence follow. A rabid impulse overtakes the patient to tear in pieces who and whatever opposes him. This rabid impulse greatly distresses him; and it is often strongest against those to whom he is most attached, although he struggles to suppress it. In this stage horror is strongly depicted on the countenance, every symptom is aggravated, the saliva grows thick and ropy, while the poor sufferer, not daring to make the slightest attempt to swallow, spits it out incessantly, oftentimes with frequent retchings and vomiting. In this state he sometimes turns black in the face, falling into convulsions, in which he expires; or,

exhausted by his great efforts, a sudden calm ensues, and, as if nature gave up the struggle, he dies without a groan.

Remote Cause.—Hydrophobia originates in animals of the canine and feline races, as the dog, the fox, the wolf, the jackall, and the cat, as a specific inoculable disease, but from what peculiar source is altogether undetermined. It is probably at all times to a certain extent endemic, and occasionally epidemic among these animals. It has been supposed that it is excited in them by the great heat of the dog-days, or by the *æstus veneris*; but Troillet has shown that canine madness occurs with nearly equal frequency in winter, spring, summer, and autumn. The poison is not peculiar to any country. Rabies is found equally in Europe, Asia, and America; neither is it limited to climate. It prevails in the frozen regions of Canada, as well as in the East and West Indies. The difficulties attending any explanation of the origin of this poison are at present not to be surmounted; but hydrophobia once originated in the animals that have been mentioned, they have the power of reproducing it by their bite, not only in each other, but probably in all warm-blooded animals, certainly in all domesticated animals, as the horse, the elephant, the sheep, the ox, even in the common fowl, and in man. It will be necessary to the proper understanding of hydrophobia to give a short outline of the disease as it occurs in the dog, so constantly associated with us in domestic life, and the principal source of the disease in the human subject.

The symptoms of this formidable affection, as witnessed in the dog, are some singular departure from his ordinary habits, such as picking straws or small bits of paper off the floor, and swallowing them; licking the noses of other dogs, or other cold surfaces, such as stones or iron. Besides this, he is observed to be more lonely, shy, and irritable; his voice is so changed that his bark would not be recognized by those who have known his voice before; and he is less eager for his food, or refuses it altogether. His ears and his tail droop; his look is suspicious and haggard; and sometimes, from the very commencement, there is a redness and watering of the eyes. In a short time saliva begins to flow from his mouth, he “slavers,” his fauces may be seen to be inflamed, and he is feverish. The animal, though highly irritable and easily provoked, still obeys the voice of his master; and it is remarkable “that the dread of fluids, and even

the sight of them, so striking a feature in man, is often wanting in dogs and other animals, for many dogs lap water during the disease" (YOUATT). In many dogs the symptoms never rise higher than these; but in others there is a repugnance to control and a readiness to be aroused to extreme rage on the appearance of a stick, whip, or other instrument of punishment, or on any attempt at intimidation, which strikingly characterizes the disease. In this state, however, he seldom fights a determined battle, but bites and runs away; still even this mitigated irascibility usually ends in indiscriminate aggression, till at length he dies, apparently of convulsions or asthenia; or from mere nervous excitement and functional derangement. Majendie has inspected the hydrophobic dog, and found no characteristic morbid change. In all cases, however, in which the poison has had time to set up its specific actions, the principal lesions of structure are found to be in those parts supplied partially or entirely by the eighth pair of nerves. The tongue is swollen; the fauces, the salivary glands, and the mucous membrane at the back of the larynx behind the epiglottis, are more or less inflamed. The bronchial membrane is also occasionally inflamed, and so is the mucous membrane of the stomach, which generally contains a strange mixture of straw, hair, paper, hay, horse-dung, and earth, showing the peculiar morbid propensity of the animal; or, being void of those substances, it contains a fluid resembling the deepest-coloured chocolate. Such are the symptoms and phenomena of hydrophobia in the dog, the chief source, perhaps, of this fatal malady to the human race.

The susceptibility of the human subject to this poison is by no means universal, for only ninety-four persons are known to have died out of one hundred and fifty-three bitten, making the chances of escape as three to two nearly. It has been thought this occasional immunity does not arise out of any want of susceptibility to the action of the poison, but from the person being bitten through his clothes, and the dog's tooth, consequently, having been wiped clean from all venom. Menières, however, says he met with seven cases in which the dog must have bitten through several folds, and yet they all proved fatal; showing, as he imagines, the little importance of dress as a protection from this malady.

Neither age nor sex are exempted from hydrophobia, for the

infant at the breast, as well as the old man of seventy-three, have been known to die of this disease.

No instance is known of man being affected with hydrophobia, unless antecedently bitten by a rabid animal capable of communicating the disease.

It is a question of much moment whether the saliva of a patient labouring under hydrophobia will or will not communicate the disease. It may be stated as an undeniable fact that, during the many years hydrophobia has been studied, no instance is known of its having been communicated from one human being to another, although many instances have occurred of the attendants having been bitten or otherwise accidentally inoculated with the saliva of the hydrophobic patient. The only circumstance which makes this law at all questionable is that Majendie and Breschet inoculated two dogs with saliva taken from a diseased patient, shortly before his death from rabies, and that one dog shortly afterwards died of hydrophobia. Persons have also been seized with rabies in consequence of having wiped their lips with napkins or cloths, or other articles which were soiled with the saliva (ENAU, CHAUSSIER, and AURELIANUS).

The dog's tooth generally implants the poison, or at least some abrasion appears to be necessary either of the cutaneous or mucous surfaces. The ancients were aware of this, for Celsus observes that the integrity of the lining membrane of the mouth is necessary to the operation of the *Psylli*, whose office it was to suck out the poison after the bite of a rabid dog; and Dioscorides expressly orders them first to wash their mouths with astringent wine, and afterwards to lubricate the cavity with oil. With regard to dogs, Meynill observes that "such of them as have been thought to become affected merely by the contagion of the same kennel will generally be found, upon minute examination, to exhibit the marks of bites, though concealed by the hair." When a scratch or other abrasion exists, a rabid dog merely licking the part is sufficient to implant the poison of rabies.

Diagnosis.—When hydrophobia is fully formed there is no disease with which it can be confounded; but there are many reported cases in which the imagination of a patient bitten by a dog has been so powerful as to induce symptoms resembling the disease. In hysteria the difficulty of swallowing exists, but no other symptom. Tetanus is the disease with which rabies is most

apt to be confounded; yet the differences are sufficiently marked. The spasm of the muscles is more continued in tetanus; less remitting, and never intermitting. The jaw is usually much in motion in hydrophobia, in frequent attempts to clear the mouth and throat from the peculiar tenacious mucus; in tetanus it is fixed. Tetanus is rarely attended with aversion to liquids, on the contrary, the bath is grateful; nor are the tetanic paroxysms increased by the sight, hearing, or touch of fluids. Also, tetanus makes its accession usually at a much earlier period after infliction of the injury. Physiologically, while tetanus is a disease of the true spinal system, hydrophobia involves the brain also, as evinced by the disorder of intellectual function and special sense, even early in the disease. Further, the two diseases differ greatly in their mode of induction. Tetanus in the traumatic cases is caused by irritation of a nerve, and by disease of the spinal marrow in those which are idiopathic. Hydrophobia is the result of a specific poison introduced into the circulation, and thence affecting the nervous system as a poison would (MILLER). While in tetanus the stimulus which excites the paroxysms "operates through the true spinal cord, in hydrophobia it is often conducted from the ganglia of special sense, or even from the brain, so that the sight or sound of fluids, or even the idea of them, occasions, equally with their contact, or with that of a current of air, the most distressing convulsions" (CARPENTER).

Prognosis.—There are few instances of any patient or animal suffering from this disease having recovered.

Treatment.—As there are but very few authenticated cases of recovery from hydrophobia, so there are few instances of any mitigation of the symptoms by the use of medicine. All that remains is to mention the most leading experiments that have been made, with the hope that, as they have not been successful, they may not be wantonly repeated.

Dr. Hamilton gives twenty-one cases, and adds, "many hundreds more are on record," in which venesection has been unsuccessful, though copious and often repeated. Opium has been given by Dr. Babington to the enormous amount of 180 grains of solid opium in eleven hours, without the slightest narcotic effect, or the slightest mitigation of the symptoms. Nord has given a drachm of belladonna in twelve hours, without any benefit. Dr. Atterly gave to a child eight years old two

drachms of calomel by the mouth, and rubbed in two ounces and a half of strong mercurial ointment in a few hours, with an equal want of success. A case, however, is related by Ligget, which is said to have been successfully treated by half-drachm doses of calomel, given to the extent of ptyalism, induced in three days, after four and a half drachms of calomel had been taken. The case really appears to have been one of hydrophobia; and recovery is said to have been complete by the twelfth day. (*Amer. Quar. Jour. of Med. Science*, Jan., 1860.) Iron, arsenic, nitrate of silver, camphor, musk, cantharides, turpentine, tobacco, acetate of lead, ammoniacal solutions of copper, hydrocyanic acid, galvanism, strychnine, nitrous oxide, chlorine, and guaiacum, have all been given in equally large doses, but have signally failed. These include some of the most powerful medicines in the Pharmacopœia; and, in addition to these, Ploucquet, in his *Literatura Medica Digesta*, has enumerated nearly 150 others.

The failure of every remedy by the mouth, and the inefficacy of opium, of morphine, and of laurel water, even when injected into the veins, so convinced Majendie that in hydrophobia the constitution was armed against the action of any medicinal substance, that on a patient labouring under this disease being brought to the Hôtel Dieu, he determined to rely for all treatment on an injection of warm water into the veins. The patient, at the time of the operation, is represented as being absolutely insane, so as to require to be restrained. In this state, and with a pulse of 150, Majendie injected into his veins, in the course of two hours and a quarter, two pints of water, at the temperature of 100°. At the conclusion of this operation the pulse had fallen to eighty, and the patient recovered his senses, so that the strait waistcoat was no longer necessary. The sequel, however, renders it doubtful whether this mitigation was desirable at the price of the intense suffering which followed. The poor man lived eight days afterwards, but the despondency and mental agitation quickly returned, and at the end of three days the poison (or the state of the blood induced by it and the warm water) appeared to set up a new series of actions on the synovial membranes of the wrists, elbows, and knees, attended with excessive pain, so that he was unable to bear the weight of the bed-clothes, and he died in great torture. The articulations thus affected were found, on posthumous examination, to be greatly inflamed, and their

cavities filled with pus. This case is remarkable as being the one in which life was prolonged for the greatest period of time recorded of this disease. The experiment has since been repeated by Gaspard and others; but the mitigation, if any, has been so slight and transient as to give no encouragement for repeating it; and, tried on the rabid dog by Youatt and Mayo, it proved eminently unsuccessful.

The property which some animal poisons have of controlling and of interrupting the actions of other morbid poisons on the constitution has caused even animal poisons to be tried in the cure of this disease. The rapid and powerfully acting poison of the viper led to the hope that the bite of that reptile might prove an antidote to the hydrophobic virus; but the experiment, tried in France, Germany, and Italy, upon animals, has been entirely unsuccessful. M. Grindard conceived that the vaccine virus might influence hydrophobia, and he vaccinated a hydrophobic child in three places, and afterwards injected five charges of vaccine lymph into the veins; but the child died without any marked remission, and in the usual time. The following draught has been found rather to promote euthanasia than to hold out any prospect of cure:—

R. Spirit. Æther. Sulph.; Tinct. Opii. ā ā mxx.; Spirit. Ammon. Aromat. ℥ss.; Chloroform, mxx.; Mist. Camph. ℥iss.; *misce*. To be given as often as may be *considered safe* (CUNNINGHAM, CARDEN).

Preventive Treatment.—The probabilities are, that unless the operation of excision, of cauterization, or of applying the cupping-glass, be performed within a few minutes after the bite of the rabid animal, it is impossible to save the patient from the fatal disease, which, according to the susceptibility of his constitution, may threaten him at any moment. In all probability no prophylactic medicine exists in nature, and the administration of any potent substance by way of prevention is worse than useless; for without protecting the patient it may injure his constitution. Mild remedies, if they tend to tranquillize his mind and appease his apprehensions, may be innocently employed.

The theory which maintains that a zymotic incubation first takes place in the wound by which the poison is originally implanted suggests the most rational prophylactic—namely, to destroy entirely by *potassa fusa* the whole cicatrix, where prac-

licable, or by some other surgical means entirely to remove it, at as early a period as possible, and *previous* to the occurrence of symptoms. When premonitory symptoms are first observed, the following plan has the recommendation of Dr. Maxwell in *The Indian Journal of Medical and Physical Science*, and of Dr. Copland, namely,—(1.) That the original cicatrix be freely laid open, and suppuration from it speedily and freely produced. (2.) The nerves, or nerve, leading to the part are to be divided without delay, the more remote from the wound the better. (3.) Free perspiration should be promoted by the hot air bath. (4.) Bleeding from the arm to syncope, or cuppings on the nape of the neck, are modes of practice indicated by the lesions found after death.

GLANDERS—*Equinia*.

Definition.—*A febrile disease of a malignant type, resulting from the implanting of a specific poison from glandered horses. It is characterized by vascular injection of the nasal mucous membrane, from which an aqueous, viscid, glutinous, or purulent discharge proceeds, on which chancre-like sores are formed, extending to the frontal sinus and neighbouring mucous surfaces. The lymphatic glands enlarge in the vicinity of these mucous membranes. A tubercular or pustular eruption appears upon the skin, followed by suppurating, bloody, or gangrenous ulceration in various parts. A general inflammation of the lymphatics and of the glands may occur, giving rise to the small tumors known as "farcy buds" or "farcy buttons." These gradually suppurate, and secrete a specific virus.*

Pathology.—The horse, the ass, and the mule are liable to a disease termed the glanders. It occurs under two forms, named the *glanders* and the *farcy*. Many veterinarians have considered these varieties to be distinct diseases; but numerous experiments have demonstrated that they have their origin in the common animal poison. It appears, however, that there are several grades or varieties of both these diseases. Thus, if glanders be defined to be a fever with a running of matter from the nose, farriers distinguish three kinds: one consists of swelling ecchymosis and gangrene of the mucous membrane, with a discharge principally from the pituitary, tracheal, or bronchial membrane; another of a pustular eruption of the same parts followed by ulcera-

tion; while a third consists in a combination of these two forms of disease. Of farcy, also, there are two kinds: the *bud farcy* and the *button farcy*. The "bud farcy" consists in the formation of a number of tumors on different parts of the body, as on the head, neck, and extremities, and particularly on the hinder ones, these tumors being formed not only by enlargement and inflammation of the glands, but also of the areolar tissue, and which, at the end of four or five days, soften and ulcerate. Similar tumors are said to form in the substance of the pituitary membrane, which quickly suppurate and cause death. The "button farcy" is an inflammation limited to the lymphatic glands and vessels without involving in any considerable degree the areolar tissue. It usually commences in the hinder extremities, causing lameness and enlargement of the limb; and when the valves of the lymphatics become thickened, it forms a tumor called the "farcy bud," while if the lymphatic vessel itself be inflamed, it is termed "farcy pipe." It may be shortly stated, that in *glanders* the nasal passages especially suffer; while in *farcy* it is the lymphatic system which is affected.

It has been determined by a number of severe accidents occurring to persons employed about glandered horses, that the poison producing them is capable of being transmitted from the horse to the human subject, and again from the human subject to the horse and to the ass; and there is reason also to believe that it is capable of being transmitted from one human being to another. (Zimmermann, in *Virch. Arch.*, vol. xxiii, p. 209, and *Year-Book of New Syden. Soc.*, 1862.) The attention of the profession was first called to this interesting subject by Mr. Muscroft, in *The Edinburgh Medical and Surgical Journal*, in the year 1821, where he relates the case of the whipper-in of the Bradworth hunt, who wounded himself in cutting up a glandered horse for the kennel, and died, at the end of a week, of confirmed glanders; and two similar cases appeared in the same work about two years afterwards. Simultaneously with Mr. Muscroft, Dr. Copland, in the course of a discussion at the Medico-Chirurgical Society of London, stated that the fact of the disease having been thus communicated had been proved by cases that had occurred in Germany, and which were published in *Rust's Magazine* for 1821. The cases excited but little notice till Mr. Travers published his valuable work on *Constitutional Irritation*, in 1828, containing a letter

from Professor Coleman on the transmission of glanders from the horse to man, and from man to the ass, together with some other cases which had fallen under his own observation. The subject was now followed up by Dr. Elliotson, in two papers in the *Transactions of the Medico-Chirurgical Society*, narrating three cases which had occurred in his own, Dr. Roots', and Dr. Williams' practice. At length all the then known facts were collected in an elaborate paper by Rayer, in the sixth volume of the *Mémoires de l'Académie Royale de Médecine*.

In the cases collected by Rayer, the nose and nasal fossæ had only been examined in four cases out of fifteen, and in these there was found either ecchymosis, ulceration, or gangrene of the mucous membrane of the *septum nasi*, or in the sinuses. The mucous membrane of the larynx, or trachea, has likewise been found studded either with the peculiar eruption, or diffusely inflamed or ulcerated, so much so that in one case the epiglottis was in part destroyed. The lungs have likewise been found either gorged with blood, or the seat of lobular pneumonia, or of vomicæ, with typhoid symptoms—*broncho-pneumo-typhus*, as it is called in Germany. In Dr. Roots' case there was an encysted abscess of the lung, which contained about two ounces of pus. Besides these affections of the more vital organs, a number of small farcy tumors have been found in different parts of the trunk and extremities, and perfectly remote from the point originally punctured. These tumors were in different states of inflammation, some being white and indurated, others soft and injected, and others in a state of suppuration. In Dr. Roots' case an abscess on the back of the hand communicated with the articulation of the metacarpal bones; and in another case an abscess had opened into the knee-joint. The absorbent vessels have likewise been found inflamed along the arm from the point of puncture, or site of primary inoculation, and the glands to which they lead have been found enlarged and indurated, or in a state of suppuration.

The result of all these observations shows that in cases of glanders a specific poison is implanted which infects the blood, and, after a given period of latency, produces, in slight cases, an abscess at the point of puncture, followed by some tumors in the course of the absorbents connected with the punctured part. In severe cases fever is previously set up, and after this has continued for some days, there follows either a diffuse or an eruptive

inflammation of the mucous membrane of the nostrils and of the trachea, terminating in suppuration, ulceration, or gangrene; also some inflammatory affection of the lung, together with the usual farcy button or bud tumors in different parts of the body.

Symptoms.—The glanders may be either acute or chronic. Acute glanders is expressed by primary fever, followed by local inflammation; chronic glanders when the local inflammations exist *per se*. The proportionate number of cases of each kind is not determined.

The acute disease is ushered in by an attack of primary fever, with or without rigors, and followed by pains in the limbs so severe as often to be mistaken for an attack of acute rheumatism. Some days after, the pained parts become the seat of phlegmonous tumors, accompanied with much pain, redness, and tenderness; these more commonly terminate in abscess, sometimes discharging a laudable pus, but more usually a bloody sanies, and rapidly become gangrenous. Towards the close of the disease, in almost all cases, there has been a discharge of matter more or less purulent, viscid, and mixed with blood, from the nostrils. The quantity, however, has in general been inconsiderable, and sometimes scarcely appreciable. The period at which this symptom appears is not constant. It has been seen as early as the fourth, and as late as the sixteenth day. In the course of the disease the eyelids are generally tumefied, and discharge a thick viscid matter, like that from the nose; and enlargement of the sub-maxillary glands occurs.

One of the most remarkable symptoms of acute glanders in man is the eruption of pustules on the face, trunk, limbs, and genital organs. This eruption has been compared to *varicella*, to *small-pox*, and to *ecthyma*; but in fact it is an eruption *sui generis*, and cannot be compared to any other. It has been observed to occur about the twelfth day, and to be preceded and accompanied by profuse fetid sweats. Besides this eruption, a number of black bullæ have been observed on the nose, forehead, below the ears, on the fingers, toes, and genital organs, and these have been followed by gangrene more or less extensive and deep.

The pulse is full and quick in the early stages, but towards the close it becomes rapid, small, irregular, and even intermittent. The tongue varies, as in typhus, being first white and coated, and subsequently brown or black. Diarrhoea and meteorism often

complicate the disease, and blood has been observed in the stools.

Cerebral disturbance has come on as early as the second day, but more commonly not till towards the tenth; sometimes marked by a singular want of intelligence, at others by a sinister presentiment, followed by stupor and death.

Acute glanders is rapid in its course, and two-thirds of the cases have terminated before the seventeenth day; some have died on the twenty-first day, a few on the twenty-eighth day, and only one has survived till the fifty-ninth day.

Chronic glanders or farcy differs from acute glanders in the circumstance of the local lesion preceding the general febrile derangement; the introduction of the poison being followed in a few hours by inflammation of the lymphatics proceeding from the wounded part, and extending sometimes to the elbow or axilla, and involving the axillary glands. These effects are followed by inflammation and extensive abscesses in the subcutaneous cellular tissue, often involving the whole limb. From this state the patient may recover; but should these abscesses be multiplied over various parts of the body, and be accompanied either by the pustular or gangrenous vesicular eruptions, or by both, the result is generally fatal, for hectic symptoms supervene, and hasten the final catastrophe.

The disease has terminated within a fortnight, but more commonly it has not proved fatal till the end of a month; and, in cases still more chronic, a twelvemonth has been known to elapse before the patient finally recovered or died. Such are the general phenomena of acute and chronic glanders, as they have been observed in the human subject.

Cause.—The remote cause of glanders in the horse is but little understood. It is probably due to a specific miasmatic poison, having a peculiar affinity for the horse, and animals of his class. Glanders, however, when it affects the human subject, has in all instances been distinctly traced to the glandered horse as the remote cause, for no instance is known of the disease occurring primarily in man.

In the horse certain predisposing causes greatly favour, and are perhaps necessary, to the spread of glanders, such as dirty, close, ill-ventilated stables, especially if the situation be low and damp. Horses when crowded on board transports are greatly liable

to this affection. The Arab, in transporting his horses from Arabia to India, always chooses that part of the year when the passage is shortest, lest the accidents incident to a long voyage might oblige the hatches to be closed, and want of ventilation promote the development of glanders. Bad food is a powerful predisposing cause in the horse, especially when these animals are picketed on service, and thus exposed to the inclemency of the weather. At the close of a campaign the cavalry are often decimated by this disease, and towards the termination of the Peninsular war the losses from this cause are said to have been enormous. The cases occurring in the human subject are too few to allow of any inference being drawn as to the influence of the predisposing causes in the production of glanders; but the disease generally occurs in young men, and probably a close investigation would have shown that the habits of the patient were such as to fall within those laws which favour the production of the disease in the horse.

The majority of veterinary surgeons, of stable-keepers, and coach proprietors, believe that the disease is contagious among horses, and if a glandered horse has been introduced into stables, the stock in these stables have become diseased. There are few districts in which some farmer, by the loss of a considerable part of his team, has not had sufficient proof of the contagious nature of glanders. In this country the law is severe against offering for sale, or even working, a glandered horse, which shows that the opinion of our ancestors, time out of mind, has been that glanders is a contagious and a fatal disease. In Germany the belief of contagion is so general that it is said the law directs any horse that has been in contact with a glandered animal to be immediately killed. Again, Professor Coleman has produced glanders by direct inoculation from horse to horse, so also have Professors Peal and Renault, while Leblanc assures us that he has repeated these experiments till he has demonstrated that not only is glanders contagious, but that farcy and glanders are mere varieties of the same disease,—the farcy matter producing glanders, and the matter of glanders producing farcy.

Cases of the transmission of glanders from the horse to man are now numerous; and that the disease is actually glanders has been shown by Professor Coleman, who directed two asses to be inoculated with matter taken from the arm of a person

then labouring under this disease, consequent on a puncture received in dissecting a glandered animal, and both animals died of glanders. These experiments have been repeated, with similar results, by Gerard, Hering, of Stuttgart, and more recently by Leblanc, with matter taken from a patient that died glandered under Rayer, so that no doubt can exist of the fact. It seems proved, therefore, that glanders is transmissible from the horse to man, and again from man to the ass. It has been contended also, that if glanders is transmissible from man to animals, the disease must be capable of being communicated from one human subject to another; and a case of this description appears actually to have occurred in St. Bartholomew's Hospital about twenty years ago, when the nurse, a healthy woman, contracted the disease from a patient in the ward, and, after a short illness, died with every symptom of glanders.

The fact of repeated inoculation with glandered virus distinctly shows that fomites may be so infected as to produce the disease. The spread of the malady has been attributed to healthy horses having drunk out of the same pail or trough with a glandered horse, or to licking the neighbouring rack or partitions of the stalls in which a glandered horse had been placed. Mr. White attributes the occurrence of glanders in a mare and two foals to some hay left by a team of glandered horses being blown into their paddock.

The specific poison of glanders has been introduced into the system both by the cutaneous and mucous tissues. The disease has been produced by inserting the virus under the cutis with a lancet, and by rubbing it on the greasy heel of a horse; it has also been produced by inoculating the mucous membrane of the nose of the horse, or by smearing that membrane with farcied matter. Farcied matter has also been made up into balls, and introduced into the stomach of the horse, and glanders has resulted. There can be no doubt, therefore, that the poison is absorbed both by the cutaneous and mucous tissues, and that being absorbed it infects the blood. This latter fact has been distinctly proved by Professor Coleman. "I have," says this gentleman, "produced the disease first by removing the healthy blood from an ass, until the animal was nearly exhausted, and then transferring from a glandered horse blood from the carotid artery into the jugular vein of the ass. The disease in the ass

was rapid and violent in degree, and from this animal, by inoculation, I afterwards produced both glanders and farcy. In acute glanders, therefore, the blood is undoubtedly affected."

Period of Latency.—The poison of glanders has its period of latency, like all other morbid poisons, and that period is in general short. Two asses were inoculated by Mr. Turner, the one about a year and the other a year and a half old, and in the first the maxillary glands became tender on the second day, and the discharge from the nostrils was established on the third. In the other the maxillary gland enlarged on the third day, but the discharge from the nostrils did not take place till the sixth day. Sometimes, however, the incubation is much longer. In the *Procès-verbal de l'Ecole de Lyon* a case is given of a horse which was inoculated with farcy matter, but the disease did not appear till the end of three months, and then precisely at the points of puncture. M. Gerard, an ex-veterinary surgeon of the French "artillerie de la garde," states that he introduced the matter of the discharge every day into the nostrils of certain horses, by means of a brush, and that the disease appeared in one on the seventh day, but in two others not till the thirty-second day.

In the human subject the poison has in general been latent from two to eight days after the accident of inoculation.

Prognosis.—Of fifteen cases of acute glanders collected by Rayer only one recovered. Of fifteen cases of acute farcy only five recovered. Of seven cases of chronic farcy only one died. Of the three cases of chronic glanders two died. A favourable prognosis, consequently, is only warranted in the chronic form of the disease.

Diagnosis.—"Acute glanders," says Rayer, "cannot be confounded with poisoning from puncture in dissecting or opening dead bodies; for," he adds, "out of fifty such cases reported by various authors, no mention is made in them of a discharge from the nostrils, or of a nasal or laryngeal eruption being found after death, or of the peculiar cutaneous eruption." Leblanc also states that he has inoculated the horse with a great number of other morbid secretions from the human subject, but has in no instance produced any disease similar to glanders. It may for a short time be mistaken for rheumatism, but the occurrence of the secondary actions quickly dispels this error. It is perhaps impossible to enumerate every difficulty that may occur in the diagnosis; but when any doubt exists, an inquiry into the habits

and previous employment of the patient will probably solve the problem; or the inoculation of a healthy animal is an excellent counter-proof.

Treatment.—All the remedies hitherto tried in acute glanders have failed, for only one out of fifteen has recovered, and that not from any particular treatment. Blood, when taken at the commencement, has been found buffed, and some momentary relief has been afforded; but prostration and stupor have quickly followed, while leech-bites have become gangrenous. The coming on of typhoid symptoms has led to the administration of *quina*, *valerian*, *serpentaria*, *ammonia*, and other stimulating medicines; but all of them have failed. Vomiting and purging have likewise been had recourse to; but these measures have been equally unsuccessful. It is probable, therefore, that the cure of this disease depends on the discovery of a specific remedy, and experiments in treatment may be warranted as the only chance of subduing a malady which has so constantly proved fatal. In the more chronic forms of the disease the recovery of the patient has appeared to be owing to the excellence of his constitution during the natural elimination of the poison, and to a generous diet, rather than to any powerful effect produced either by general or local treatment.

Preventive Treatment.—The prophylactic treatment is the same as that of all other contagious diseases; namely, being careful to avoid all contact with the morbid poison, and especially when a finger or other part of the hand is abraded; and if by accident the veterinary surgeon should inoculate himself, he ought instantly to destroy the part with *potassa fusa*. It has been recommended, after the disease is set up, to extirpate the enlarged glands; but according to the doctrines set forth in the text, this practice is as unwarrantable as hopeless.

MALIGNANT PUSTULE (VESICLE?)—*Pustula Maligna*.

Definition.—*The result of a specific poison implanted on some uncovered part, which produces in the first instance a redness like the bite of a gnat, and afterwards a minute vesicle. A peculiar form of gangrenous inflammation is excited, which rapidly spreads from the point first affected to the neighbouring tissues. Hardening and blackening of this part is so extreme,*

and death is so entire, that the part creaks when cut with a knife—no pain attends the incisions, crops of secondary vesicles form round an erysipelatous-like areola, chains of lymphatics become inflamed, the breath fetid, and death follows amid all the indications of septic poisoning (BUDD).

Pathology and Historical Notice.—This disease has been long familiarly known and described by French, German, Russian, Swedish, Lapland, and Italian medical men; and it proves fatal every year to a large number of persons in various parts of Europe. British medical men are not generally familiar with the disease; and its occurrence in this country escaped general recognition till the admirable papers of Dr. William Budd on the subject (read at the meeting of the Medical Association in London, and published in the *British Medical Journal* of this year, 1863), gave a full account of the literature of the subject, and showed that malignant pustule has been long known in this country as an epizootic, causing every year a large mortality among English live stock. The "*joint murrain*," "*black quarter*," or "*quarter evil*," and the "*blood*" (the name by which the malady is known in the sheep), are the same diseases as the "*charbon*," "*quartier*," and "*sang*" of the French, and the "*milzbrand*" of the German. From the writings of Dr. Budd on this subject, the following account of this remarkable and terrible disease is taken. The disease has prevailed from time immemorial, in various continental countries, in oxen, sheep, horses, and other animals; and, concurrently with the cases of malignant pustule, which are the result of direct inoculation from the morbid material of those animals, other cases occur in which the exact vehicle of the poison cannot be identified; but these cases have all the significant peculiarity, that the disease is always *seated on some part of the person which is habitually uncovered*.

In animals, and especially in oxen, the action of the specific poison seems to be even more virulent than it is in man. Death is more speedy; there is a more rapid spread of gangrene; and, while the animal is yet living, the extrication of fetid gases from the tissues of the parts affected goes on to a great extent. The contagious property of the poison is possessed in the highest degree by the lymph contained in the characteristic vesicles, and next to this, by that peculiar exudation which occurs in the areolar tissue of the affected part, and in that of various paren-

chymatous organs, and sometimes in the serous cavities of the chest and abdomen.

The identity of the malignant pustule of man with the "*charbon*" of cattle has been satisfactorily proved, by the fact that the disease, when contracted by man, has been communicated back to the animal, by inoculation from man.

It is only at the onset that the disease is a local one; but very soon general poisoning ensues, which is due to the after diffusion of the morbid changes and products engendered in the part first affected. This is a very important point in the pathology of the disease, and with a view to successful treatment; and it is inferred, not only from the order in which the morbid phenomena succeed each other, but still more clearly from the fact that the early destruction of the diseased part by caustic not only prevents the development of the constitutional disorder, but in many cases issues in a perfect and speedy cure.

Propagation of the Disease.—The disease may be communicated to man in the following ways:—(1.) By direct inoculation, as in the case of butchers, farmers, skimmers, herdsmen, drovers, and others, in whom accidental inoculation with it appears to be an event of no uncommon occurrence in countries where "*charbon*" is most rife. (2.) By means of the skin, or simply by the hair of diseased beasts. Trousseau, for example, relates that, in two factories for working up horse hair imported from Buenos Ayres, and in which only six or eight hands were employed, twenty persons died in the course of ten years from malignant pustule. There are many other cases related by Dr. Budd, and some which clearly show that the virus of *malignant pustule*, like other contagious poisons, when once in the dried state, may retain its powers for an indefinite period of time. The disease may thus be propagated through contact with bones, hoofs, horns, and the fat and tallow of animals dead of the "*charbon*." (3.) The disease may be communicated by eating the flesh of animals killed while affected with it, as also by using the milk and butter of affected cows. (4.) Insects which have been in contact with the bodies or carcasses of diseased cattle may communicate the disease to man. Most commonly it is the insects with piercing probosces, such as gad-flies, after having sucked the putrid juices of dead or sick animals and then settled on the persons of men, which effect the inoculation; but flies which make no wound may also

implant the poison on the skin by their soiled wings and feet (VIRCHOW, BOURGEOIS). The latter observer says "he has seen the disease produced by the puncture of a gad-fly, which came out of a fleece of wool" (BUDD).

Phenomena and Symptoms of the Malignant Vesicle.—A considerable degree of pruritus in the part is succeeded by the appearance of a red spot like a flea bite. A vesicle, in the course of twelve or fifteen hours afterwards, may be observed, at first about the size of a millet seed, but very soon it acquires larger dimensions, and, if not ruptured by the patient, bursts spontaneously, and dries up in about thirty-six hours, leaving the exposed *cutis vera* dry, and of a livid colour. Twenty-four or thirty-six hours after the attack (itching having now ceased), a small, hard, and circumscribed nucleus—the "*parent nucleus*" of Virchow, the "*malika*" of the Russians—having the form and size of a lentil, is perceptible under and around the seat of the vesicle. In the circumference of this a soft but still resisting swelling, of a reddish or livid colour, forms an inflamed areola, and becomes covered eventually with secondary sero-sanguinolent vesicles, similar to the vesicle which first appeared. These are at first isolated, but speedily they become confluent. The central spot may contain at first a transparent, bright, yellow fluid, which very early becomes reddish or bluish; then of a brownish hue, when the spot becomes extremely hard, very insensible, and rapidly becomes gangrenous. The inflammation extends to a considerable distance, both in depth and circumference; the neighbouring skin is red and shining; the subcutaneous areolar tissue is puffy and emphysematous-like; the excoriated surface readily dries up, and becomes, as it were, mummified; and in its neighbourhood new vesicles spring up, which run the same course as the former. The part soon loses its vitality, so that it may be pierced with needles without the patient becoming aware of it. It is also a remarkable feature of *malignant pustule* that severe pain is generally absent. If the disease ceases to advance, an inflamed circle of vivid redness now surrounds the gangrenous portion, the tumefaction diminishes, and the patient experiences something like an agreeable warmth, accompanied by a pulsatory motion of the affected part. The pulse, which before was irritable and feeble, begins to revive, strength increases, a gentle perspiration indicates the crisis of the febrile state, and nausea ceases. Separation commences between

the living and the dead parts, and is attended by copious suppuration. If the disease should not tend to a favourable issue, suppuration does not take place; the gangrene spreads rapidly; the pulse becomes smaller and more contracted; the patient suffers from extreme lassitude and inability to sleep; and, finally, with a tendency to syncope, he becomes passive as to the result. The tongue is dry and brown, the features shrink, the skin is parched, the eyes are glassy; cardialgia and low delirium indicate the approach of the fatal termination (BUDD, RAJER, VIRCHOW, BELL, CRAIGIE).

The face (often in the lip, or immediate neighbourhood of the mouth), the neck, the hands, the arms, and the legs are almost the only parts on which it appears; and if by chance it becomes developed on other parts, we may be sure the poison has been carried there directly by the fingers, or other agents impregnated with the virus. The phenomena, therefore, which such cases exhibit in man are identical in every particular with those which have been seen in farriers, and others in continental countries who have the charge of cattle, and who in numberless instances are known to have become diseased from the accidental but direct inoculation of the "*charbon*" virus.

Treatment.—The affection only admits of cure when to the uninformed its aspect is trivial; and it can only be cured by a process which leaves a mark. To make an abiding scar on the face, for the treatment of what, at the worst, appears to be no more than a common boil, is a serious consideration for the reputation of the medical man in his practice amongst ignorant people.

The progress of the disease is only certainly to be averted by the use of caustics; and of the various caustics in use the evidence appears to preponderate in favour of *potassa fusa*; although Chaussier and others prefer *nitric acid* or the *chloride of antimony*. But everything hangs on the recognition of the disease in its first stage (BUDD).

SYPHILIS—*Syphilis*.

Definition.—*The result of a specific poison implanted on some part of the body, but generally through a venereal sore. A peculiar series of phenomena supervene, which mark the general infection of the system. The principal anatomical signs of*

general infection consist of induration (specific) round the spot where the virus has been implanted, induration of the lymphatic system of glands, the formation of nodes or gummatous nodular tumors in the connective tissue generally, and especially in that of the true skin, bones, mucous membranes, and solid visceral organs—e.g., liver, brain, lungs, and heart. A cachectic condition of the system accompanies the phenomena of infection; and indurations may remain in the form of hardened fibrous tissue in various parts of the body, for an indefinite period of time.

Pathology and Morbid Anatomy.—Advances in Pathology of late years have not been more marked in any direction than in demonstrating the very remote effects which some venereal affections exercise upon the organs and the constitution of man.

These advances are due to clinical, experimental, and *post-mortem* observations. They have shown that a considerable number of doubtful cases of ill-health are in reality due to the specific poison of a venereal disease, whose morbid effects are not fully developed till many days, months, and even years after inoculation.

Hitherto surgeons have claimed syphilis as their peculiar field; but after the surgeon had healed the sore, the morbid influence of the poison in many cases still remained, and internal lesions, impaired health, and degenerate constitution, eventually brought the patient to consult the physician as well as the surgeon.

Here the pure surgeon and the pure physician must condescend to forget their purity; for the relations of syphilis are so vast and complicated that the physician, as well as the surgeon, must combine their knowledge and their skill before the many interesting points in the pathology of syphilis can be fully cleared up. To heal the sore and obtain a cicatrix is but the beginning of the end.

It is partly to this unscientific division of the wide field of medical practice that the phases of opinion regarding the pathology of syphilis have been so remarkably diversified. *The surgeon* alone saw the primary sore or inoculation, and only by chance he might see the development of the future lesions, now so important in pathology. *The physician*, on the other hand, rarely saw the primary sore; and when he now sees the victim of secondary and tertiary syphilis, the case is often extremely complicated, "mixed up with and overlaid by other constitutional

and local diseases," which in their turn are made more serious by the existence of syphilis.

After a period, indeed, of scepticism and doubt we are now confirming, by actual observations (aided by all the advanced knowledge and appliances of the day), the crude surmises of the early physicians regarding the pathology of syphilis.

It was taught by Sir Astley Cooper that "some parts of the body are incapable of being acted upon by the venereal poison, as the brain, the heart, and the abdominal viscera. Indeed," he writes, "this poison does not appear to be capable of exercising its destructive influence on the vital organs, or on those parts most essential to the welfare and continuance of life." (*Lectures on Surgery*.) The very reverse of this is now proved to be the truth; and the physicians of the sixteenth century were more advanced in their views than one who was among the most eminent surgeons of the present century.

Towards the close of the fifteenth century a great epidemic of syphilis pervaded Europe; and the historians of the disease described a form of neuralgia as one of the remote results of the venereal poison. In the sixteenth century syphilis was clearly recognized as the result of a specific poison or virus. It was believed to be capable of combining with all other diseases, and so to modify them and to give them new forms. Even then it was recognized as producing phthisis, diarrhoea, dropsy, skin diseases, profoundly affecting the system, and demonstrating its presence by remote general symptoms of ill-health (PARACELSUS). Towards the close of the seventeenth century the ulterior results of venereal disease were fully recognized; but they were believed to be due to bad treatment. Van Swieten taught that *no organ* escapes the influence of the venereal poison. He recognizes it as the source of gummy tumors, exostosis, deep-seated pains, apoplexy, epilepsy, blindness, deafness, paralysis. Benjamin Bell is the first writer on syphilis who puts forth clinical facts in support of his belief that "the venereal disease induces blindness, amaurosis, deafness, phthisis, rheumatism, epilepsy, mania." There is no disease which more imperatively demands the careful study of the profession at this time, and especially of the army medical officer. The specific distinctions between the "infecting" and the "non-infecting" poison, and the characteristic phenomena they induce, are now being recognized at most of the

continental schools. They are distinctions of value in practice, and likely to become as knowledge becomes more defined. Even to see a *primary sore*, and watch it, we are of absolute certainty, at an early period of its course, the patient will or will not be the subject of it.

A history of syphilis in soldiers is too often that of a fatal disease. The impairment of the system from the date of the *infecting* syphilitic chancre, through general cachexia, through early implicating the glands, leading to impoverishment of the blood, the result, and then to the degeneration or wasting, eventually terminates in death, with complications especially implicating the internal viscera.

No statistical Nosology gives any idea of the loss to the public service from syphilis. The loss alone is equal to the loss of more than one-third of every soldier in the service.

Dr. Balfour relates in the last (1860) interesting *Medical, Sanitary, and Statistical Report of the Army Medical Department*, that "more than 100,000 admissions into hospital have been on account of venereal diseases (369 per 1,000); and the average length of stay in hospital is equal to 23·69 per 1,000 of strength; the average remaining in hospital on an average 23½ days; the deficiency is constantly equal to about 2½ regiments; he also observed the individual history of 1,125 men; 536 of these men gave rise to 212 were admitted *once*; 292 *twice*; 210 *three times*; 120 *five times*; 114 *six times*; 42 *seven times*; 10 *nine times*; 1 *fourteen times*.

These figures have great practical significance. They tell us how many of these men became constitutionally diseased. They do not tell us in how many the development of venereal lesions of tuberculous inflammation "the influence of an *'infecting'* sore.

The Director-General very properly requested that the ulcers be fully described, and the case fully reported. The request was complied with in the fullest manner, and the most valuable results would accrue to science

From the nature of the facts and data about to be considered, the great importance of this request will at once appear; and the necessity of describing most fully, distinctly, and clearly the origin and development and results of venereal sores, as far as possible, will appear obvious.

With a view to this accurate investigation and recording of results, the following points are worthy of notice:—

1. The nature of the contagious principle of the syphilitic poison, as expressed in the opinions of the most trustworthy observers in this and other countries.

2. The characters and the phenomena which distinguish a sore that will contaminate or infect the system, and one which will not.

3. The vehicles or media by which the specific or "*infecting*" virus may be inoculated.

4. The secondary lesions and local growths in the internal viscera which are now so uniformly found to be associated with a history of syphilis, and which are the remote effects of a specific venereal poison.

1. **Nature of the Syphilitic Poison.**—The disease develops itself after the introduction of a specific virus; and the source of the poison is more distinctly traceable than that of the miasmatic order of diseases. The actual substance or matter which contains the virus can be obtained, and can be inoculated. Yet the *active principle* of the poison has not been isolated by any chemical process.

The poison of syphilis undergoes a multiple process of elaboration or development in the system before its full effects are completed; and the lesions it induces demonstrate some of the most interesting points in the pathology of the multiplication or reproduction of the venereal poison. It is this multiplication which ultimately destroys life, through a general degeneration of the tissues and the establishment of a cachexia; or by the induction of grave lesions in important visceral parts, such as the brain, the lungs, the liver, or the kidney.

The earliest effects of the syphilitic poison upon the system become established during the occurrence of a "*hardening process*" which ultimately surrounds an infecting venereal sore—the local papule and its subsequent ulcer or sore.

This hardening process is peculiar, but not constant as to the local sore; but it is constant as regards the glands or lymphatics.

It occurs in *one or other* of the three following conditions:—1. Hardening or induration of *sores and glands*; 2. Hardening and induration of the *cicatrix and glands*; 3. Hardening and induration of *lymphatic glands only*, the original local lesion never having become hard (SIGMUND).

From these specific and characteristic local conditions, as from a focus, the system eventually becomes contaminated. The steps or sequence of phenomena associated with this contamination are not yet clearly understood. It is known only from the effects of contamination that the original virus has become *intensified* in its action, its pernicious influence more active and obvious, while its specific secondary and tertiary effects become more fully and extensively developed. These secondary lesions are even known in some forms to be inoculable.

2. **Characters of Venereal Sores.**—There are several independent affections to which the common name "Venereal" may apply, each capable of transmission from person to person within certain definite periods. From time to time it has been a subject of discussion, "Whether these *several affections* are due to one and the same virus, whose action is modified by admixture with *secretions*, or by peculiarities of constitution on the part of the recipient?" or, "Whether a separate specific poison exists for each form of venereal disease?" This latter alternative is now proven to be true; and the following are the classes of venereal affections which are specifically distinct:—(a.) Gonorrhœa; (b.) "Simple" "non-infecting" chancres, ulcers, or sores; (c.) "Infecting" chancres, papules, ulcers, or sores; (d.) Mixed chancres—the combined result of the virus of (b.) and (c.); (e.) Subsequent lesions retaining specific powers of contagion (some forms of secondary syphilis).

The History of the identification of the nature of the separate poisons which give rise to the several venereal affections arranges itself into three periods as to time, and is comprehended in the records of the past century.

1. *The Period and Doctrine of Hunter*—*The Hunterian Chancre.*—Hunter taught the doctrine, now known to be an error, "That the various forms of syphilis and gonorrhœa depend upon one and the same poison—that the matter or virus produced in both is of the same kind and has the same properties. He believed that he had established, by experiment and observation,

that the discharge from a gonorrhœa will produce either a gonorrhœa, or a chancre, or the constitutional affections of syphilis—and that the matter from a chancre will indifferently give rise to either of these venereal affections.

Hunter rested his belief and his doctrine mainly on an experiment on himself. He dipped a lancet in the venereal matter from a gonorrhœa. He made two punctures in his own penis with the lancet so charged. One inoculation he made on the glans—the other on the prepuce. *Two distinct results followed, each of them marked by a distinct and specific period of incubation.*

The inoculation on the PREPUCE was followed by itching from the third to the fifth day. On the fifth day the site of the puncture was red, thickened, and swollen. A speck became visible; and in a week this speck commenced to discharge. The urethra at the same time began to indicate the commencement of a discharge.

The inoculation on the GLANS was followed by itching fourteen days after the puncture was made: three days later a speck appeared where the puncture had been made. The speck became a papule, then a pimple, and then discharged yellow matter.

The sore on the prepuce broke out several times after it healed up; but the sore on the glans never broke out again after it healed.

The secondary lesions of syphilis followed this experiment, demonstrating the “infecting” nature of a virus with which he had been inoculated. Ulceration of the throat commenced in due time, and copper-coloured blotches on the skin followed in the usual sequence. The time the experiment took, from the first infection to the complete cure and elimination of the poison, was three years.

Now, with the knowledge of syphilis which we possess, can we say from which of these sores the constitutional disease arose?

Hunter believed he had inoculated the discharge of a specific gonorrhœa *only* and *alone*. Had the person a concealed chancre from whom Hunter took the virus? Was the patient suffering from constitutional syphilis at the time he had a gonorrhœa?

Besides Hunter, Carmichael in this country taught the same doctrine of a *single* virus; and Cazenane in France.

II. *The Period and Doctrine of Ricord.*—Ricord established, by

numerous experiments repeated in various ways,—(1.) That the inoculation of gonorrhœal discharge by the skin was followed by no specific result; (2.) That *at least two*, if not *three*, distinct poisons existed—namely, *one virus* which would produce a gonorrhœa—another *virus* which would give rise to a syphilitic ulceration—a chancre.

The ulceration of a chancre he observed to follow a very definite course. It commenced, as a rule, within twenty-four hours after the inoculation of the poison. A pustule formed, which breaking, a *soft* or suppurating chancre was the result.

Ricord eventually recognized *two* classes of chancres—the *soft* and the *hard*; but he described them as originating in the same way—by contagion from a similar primary sore. His experiments were exclusively of one kind. Either they were made on persons already affected; or on persons concerning whom it was not ascertained whether they had been infected before or not.

Hunter showed that the secretion from *one* kind of syphilitic sore is not capable of being inoculated on the same body that produced it. We know now that the discharge from the “*infecting*” sore cannot be inoculated on the already infected person; and Ricord has shown that the *plastic lymph*, the increased growth of tissue round a true chancre—the sclerosis or induration—does not take place a second time on the same subject; while Sigmund and many other observers are now agreed that the “*infecting*” disease does not repeat itself. This brings us to—

III. *Period in the History of Syphilis.*—Its commencement is of very recent date—since 1856; and is characterized by a belief in the *duality* of the venereal virus.

The surgeons of Lyons—Rollet, Diday, and Vennois—Mr. Henry Lee, of the Lock Hospital, and Mr. Henry Thompson, of University College Hospital in London, Hubbenet, of the Syphilitic Clinique at Leipsic, Sigmund, of Vienna, and Von Barenprung, of Berlin, are those who, by experiment and careful observation, have thrown most light on this remarkable disease.

In addition to the specific virus of gonorrhœa (which may now be eliminated as distinct from those about to be noticed), these observers recognize two forms of syphilitic disease, distinct at least *in their origin*. They recognize, also, specific differences in the mode of development and the sequence of phenomena which distinguish an “*infecting*” and a non-infecting” sore. They have shown

that the sore which eventually *contaminates* the system commences differently from the sore which does not infect the system. The "infecting" sore commences as a papule, pimple, abrasion, fissure, or crack, around which a specific growth of tissue takes place—a *sclerosis* or *induration*. A pustule is no essential part of the process, nor is ulceration. They are accidental phenomena, the result of irritation, pressure, or laceration, which produces a sore or ulceration—a result always very easily established and maintained.

In women the open sore is said to be still more rare as the form of "infecting" sore. In them it is always a papule (SIGMUND, CLERK). A hard chancre or sore in them is exceptional; and when it does occur, it remains small, is ill-developed, and is readily overlooked. Another peculiarity connected with the "*infecting*" sore in women is, that papules form along the course of the superficial lymphatics; and Ricord admits that induration is generally absent or ill-developed in primary sores in the vagina.

When the papule opens and becomes a sore, the fluid discharged from its open surface has been shown by Hubbenet, Lee, and Rollet to furnish a diagnostic test of the kind of disease, and of the sore from which it proceeds. Sigmund does not go so far as this. He does not consider the sores or chancres so different in form or character as to be at once distinguishable, the one from the other. He waits to see the virus produce *part* of its effect upon the system beyond the site of inoculation. He waits to see the lymphatics indurate. He believes that then, and not till then, the distinction can be absolutely drawn, and can be of use in practice. He believes (1.) that if induration of the lymphatics does *not* take place within six or eight weeks, and (2.) that if repeated successful auto-inoculations can be made on the bearer of the chancre during this period, then it is certain that the sore will not infect the system. If, on the contrary, the lymphatics indurate, and auto-inoculations cannot be effected, then the sore is assuredly an "infecting" chancre.

The addition to our means of diagnosis from the nature of the discharge—pus from the one, not from the other—is one of great value when it can be made, because the diagnosis as to the probability of subsequent infection may in some cases be made earlier.

Period of Incubation.—The time of commencement after inocula-

tion or contagion is of great importance to period of incubation exists for the "infectio Rollet fix the period at twenty-four days in primary sore; but at twenty-six days in secondary lesion. Sigmund, of Vienna, fixation at from fourteen to twenty-one day be longer, but never beyond six weeks or circumstances which may protract the exhausting fevers, pregnancy, anæmia, and

Contamination of the System.—The "infection" remain merely a local disease. It contaminates by zymosis or multiplication to one and most lasting, and most destructive for that affects the human frame. How is this only constant index of such secondary disease to be the occurrence of multiple enlargement of glands, which begins about ten or twelve days after ulcer, or chancre appears; or from four, five, or six days after contagion. This, too, may be delayed by three months after contagion, but not later than three months. They enlarge slowly, and in the immediate vicinity of the sore; and eventually the axilla become similarly affected; and ultimately the chain of glands extending up towards the sterno-mastoid muscle, is apparent. A contamination of the whole system is the result of the enlargement of the lymphatic glands. Nutrition becomes changed; it becomes anæmic. Emaciation. The digestive organs are impaired in function by their hardness, elasticity, and energy; and syphilis set in.

The following table exhibits a scheme of the phenomena after inoculation and estimated from the first appearance (SIGMUND).

		Day—9th			
I. INDURATION OF SORE,	Cases—71				
		Week—4th	5th	6th	7th
II. ENLARGEMENT OF GLANDS,....	Cases—81	44	56	74	
III. SPOTS ON THE SKIN,	"	—	2	41	68
IV. PAPULE AND PUSTULES,	"	—	—	—	3
V. AFFECTIONS OF FAUCES,	"	—	—	—	7

Cutaneous Affections.—Besides the general involvement of the glands, the condition of the skin may further demonstrate the contamination of the system. In the more insidious form of contamination its colour generally is altered. It becomes pale, white, fawn, yellow, or brown; and is wrinkled, dry, harsh, rough, and hard, and no longer soft and elastic. The eruptions are papular, pustular, or scaly, and they are peculiar in their symmetry of distribution, and in the curvilinear character of their grouping. They leave behind them stains of colour, pale cicatrices, or persistent ulcerations of the true skin. The local distribution of the syphilitic eruptions are also peculiar (DIVERGIE). "Their seats of election in the order of frequency are,—(1.) The parts round the alæ of the nose and the angles of the mouth; (2.) The roots of the hair at the forehead and back of the neck; (3.) The inner angle of the eyes; (4.) The centre of the breast; (5.) The inner side of the limbs, the neighbourhood of the axilla and the groins.

The Affections of the Fauces are often not more than a peculiar colour of the mucous membrane, persistent, however, like the staining of the skin (GAIRDNER), and eventually leading to disorganization. In women the process often ceases with a slight follicular swelling of the mucous membrane of the fauces, tonsils, and soft palate (SIGMUND). If the process does not cease, then superficial erosions or deep ulcers of the soft palate supervene. Or still more diffused forms of ulceration may set in, involving great destruction of parts, and spreading in all directions—encroaching on the nasal fossæ and pharynx, eating away the epiglottis, extending down the air passages, and even causing necrosis and exfoliation of the cartilages of the larynx.

Second Attacks of Syphilis.—The general infection is of such a kind as to render the system, as a rule, proof against a second invasion of the specific "*infecting*" virus. The disease never repeats itself, except, it may be, after a very long interval. Sigmund has seen such a case. In this respect it resembles other virulent diseases acknowledging a specific virus as their origin; and in them the immunity is usually but not invariably complete—*e. g.*, small-pox, cow-pox, scarlet fever, and the like. After the system is once infected the specific sore cannot be transplanted by contagion or inoculation to any other part of the body. The "*infecting*" sore is not *auto-inoculable*; and a person suffering from a chancre infect-

ing his system will not be affected by a further inoculation of the same specific virus. There is, however, a slight qualification to be made here. Mr. Henry Lee has shown that (1.) There is a *stage* in the existence of an "*infecting*" sore when it is *auto-inoculable*. That period or stage is a very early one in the existence of the sore—namely, before any specific systemic action has begun to develop. If at this period the poison of another "*infecting*" chancre from another person, or from the chancre already existing on the same person, be inoculated, then a second "*infecting*" chancre, accurately representing the original, will result. The period when this event can happen is *before* the gland induration. (2.) Mr. Lee has shown that there is a *certain condition* of the chancre in which, at any stage, on being inoculated or transplanted, it will produce a sore. It then appears to be auto-inoculable. But this is only in appearance, and not in reality. The condition of the chancre that does this is one of *irritation*. Blister a chancre, or irritate it by an irritating ointment, or by any other means, so as to cause pus to flow—free pus corpuscles being generated—and then we may have what has been recently termed a "*mixed chancre*," of much more frequent occurrence than has generally been supposed (SIGMUND). Sigmund has produced such chancres by inoculation. The utmost caution, therefore, is necessary before pronouncing a sore to be *non-syphilitic*—i. e., "*non-infecting*." Sigmund inoculated the pus of a soft, contagious, or suppurating sore, upon the infiltration or sclerosis of a hard papule on which the skin had remained unbroken. Between twenty-four and forty-eight hours a suppurating ulcer was established, which afterwards assumed Hunterian characters. Inoculation of two poisons may thus be in some cases simultaneous or successive. Hence "*mixed chancres*" present two aspects: on the surface is the soft, contagious, pus-producing ulcer; while deeper down is the specific syphilitic infiltration of the true "*infecting*" virus. Local plugging and enlargement of the superficial absorbents take place from such "*mixed chancres*," followed by similar infiltration of the group of lymphatic glands nearest to the sore, spreading gradually to distant and more distant groups. This is the constant series of phenomena of "*infection*,"—a regular series of connected events, giving rise to a series of symptoms seen in no affection of the system except that due to syphilis.

In many cases of sloughing phagedena the syphilitic poison at once induces slough, as in the case of snake bites, already referred to at page 662, when the tissue and virus both die. Such cases do not, as a rule, infect. So, also, if the part is made to slough by escharotics, both the virus and the tissue may be destroyed.

On the other hand, the sore which does not infect, and which does not contaminate, is the "soft," suppurating sore—the "chancroid ulcer," as it has been called—or the simple contagious ulcer of the genitals. It is purely a local disease, and is generally very soon accompanied by an enlargement of the lymphatic glands, which goes on to suppuration, and ends there. This sore may be transferred or transplanted at will, by contagion or inoculation, from one part of the body of the patient to another, or from one person to another. It is thus auto-inoculable, and is always so, the period of incubation being short—about twenty-four hours only.

Numerous sores of this nature may exist on a person at one and the same time; but *successive infecting sores* do not, as a rule, ever exist on the same person. The *multiple* character of the simple sore is now generally recognized, and likewise the *solitary* character of the infecting one. The soft chancre is altogether a local sore, and so remains; while thousands of them may be multiplied at will successively over the same person's body.

As far back as 1856 Mr. Lee showed, and Mr. Rollet since then has also shown, that not only is the infecting sore not capable of being transmitted from one part of the body to another, but it is not inoculable upon a person who has been already contaminated by syphilis, more particularly so long as lesions continue to develop themselves. It is, therefore, as necessary now to distinguish "infecting" and "non-infecting" sores as it is necessary to distinguish the various forms of continued fevers.

In future experiments and observations as to the effects of primary syphilis, it must be remembered that the subject cannot be studied or experimented with, to any extent, upon the patient himself. For this reason many of the early observations of Hunter and Ricord are limited and fallacious: one might as well attempt to study the vaccine disease by re-inoculation of it on the same person a second time, immediately after it has produced its specific effects.

Nomenclature.—*Syphilis*, comprehending primary, successive,

and constitutional symptoms, should be distinguished from simple *venereal* ulceration not followed by gland complication. The etymology of the term "*syphilis*" is unknown; but as now used the term "*syphilis*" ought to comprise (1.) the primary and (2.) the successive constitutional symptoms or phenomena which result from the contamination of the system. A man may have had a chancre and a suppurating bubo, and remain free from any taint. Such a case should not be set down as a case of syphilis, but simply as a case of "*venereal ulceration*" with *glandular complication*.

Chancre and syphilis should be reserved to designate the more serious complaint, in which the constitution is implicated, and in which the infecting phenomena occur.

3. Vehicles or Media by which the Specific "Infecting" Virus may be Inoculated.—Besides the discharge (non-purulent or mixed) from an infecting sore, there are at least three other sources of infection, namely,—(1.) The contagion of secondary syphilitic sores—*e. g.*, the syphilitic secondary ulceration of the female nipple, inoculating the mouth of the infant. (2.) It is now also established that *secondary* syphilitic inoculation (*e. g.*, the discharge from the softening and ulceration of gummatous tumors, mucous tubercles, papules, and the like) gives rise to a sore which exactly resembles a primary infecting chancre (LEE, ROLLET, VENNOIS). But it is said to differ in the following particulars, namely,—(a) The period of incubation is said to be somewhat longer; (b) Ulceration is superficial; (c) The sore heals in a shorter time; (d) Induration is less marked; (e) The constitutional infection is longer in developing itself; and (f) The lesions which result are said to be not again contagious. Thus it is supposed the great epidemic of the fifteenth century gradually abated. Hence also, perhaps, the modern belief in the modifying influence of syphilization may to some extent be explained;—an operation which is not warranted by the present scientific knowledge we possess. (3.) The blood of secondary syphilitic cases inoculates.

Among the vehicles or media by which the specific "infecting" virus may be inoculated, one of the most important to remember is the blood of those suffering from acute secondary syphilis. Experiments at Florence, at the Clinique for venereal diseases, show that healthy persons may be inoculated with the blood

of syphilitic patients. It is related that, on Jan. 23, 1860, two young doctors were inoculated with the blood of a syphilitic patient, but no result followed; on Feb. 6, 1862, three other doctors (perfectly free from syphilis) were inoculated by venous blood taken from a female suffering from the acute lesions of secondary syphilitic disease. Charpie soaked in the blood was applied to an abrasion in the arm of each. On March 3 (twenty-five days after the operation) a slight itching and elevation was perceptible, a papule formed, which, eight days afterwards, became covered with a crust. This crust increased in thickness day by day, and twelve days after the appearance of the papule two glands in the axilla became enlarged, and the sensibility of the papule increased. Nineteen days after its appearance the crust fell off, leaving a funnel-shaped chancre, with elastic resistant borders. On the twenty-third day the chancre had increased in size and induration. On the fortieth day eruption on the skin and glandular swellings in the neck supervened. The erythema lasted eight days, and pursued a regular course.

On the forty-eighth day the glands had increased in size and hardness, the chancre maintaining its specific condition, and showing no tendency to heal.

On the fiftieth day the colour of the erythema became decidedly coppery, and treatment by mercury was now begun. In these experiments the blood communicated disease to *one* out of *five* who submitted to the experiment. The recognition of this fact explains many occasional cases of syphilitic affection hitherto obscure—*e. g.*, syphilis from vaccination, contamination of a healthy nurse from the sore mouth of an infected infant, and the like. One of the most remarkable and lamentable instances of the inoculation of syphilis through vaccination is that which is now well known as the epidemic at Rivalta. At that place no fewer than *forty-six* children became affected with syphilis, the disease being communicated to each of them through the operation for vaccination (PACCHIOZZI, SPERINO, *New Syden. Society Year-Book*, 1861-62).

Hints for the Investigation and Description of Syphilitic Ulcers.—

1. Ascertain as near as possible the date of contagion, keeping in view the media or vehicles of contagion, in addition to virus from a true primary chancre—namely, from ulcers in acute secondary syphilis; from the blood of patients suffering from

acute secondary syphilis; from mixed virus; from sloughing sores carrying the virus.

2. Examine the patient, keeping in view:

(a.) That the soft, "non-infecting" sore appears immediately (*i. e.*, twenty-four hours to a few days in connection). It commences as a red swelling, and very soon into a pustule and soft suppuration.

(b.) That the "infecting" sore does not appear at the end of the second or beginning of the third week (twenty-four days); and if the disease has reached the secondary ulceration, not before the expiration of the fourth week (RINECKER). A specific sore is that of a papule, abrasion, fissure, or crack; the ulcer discharging pus, being an accidental chancre.

3. Examine microscopically the discharges from the sores, keeping in view (1.) That a "non-infecting" sore discharges pus cells; (2.) That the fluid from an "infecting" sore is not pus, but a molecular fluid.

4. The irritation of an "infecting" sore is not due to the discharge of pus, along with the "infecting" chancre.

5. The soft, purulent, non-infecting sore can be touched at will, and at any time, on the patient's behalf. The "infecting" sore cannot be multiplied after general infection becomes developed. It is not a general infection.

6. Look every day for cutaneous evidence of the existence of a primary sore.

7. Examine the lymphatic glands—not only the chancre, but also those in the axilla, occiput. Note as to the slowness or rapidity of their enlargement—hardness or softness—tendency to suppurate or not.

8. Nomenclature to be especially attended to.

Syphilization.—By this name an operation has for its object the eradication of syphilis. It is accomplished by repeated inoculations of the virus. Dr. B. is the most persistent advocate of this method in all syphilitic cases as a remedy against constitutional disease.

It may be useful to explain here in brief the doctrine of Syphilization.

In 1844 a young French physician—Auzias Turenne—commenced a series of experiments with the view of testing John Hunter's doctrines regarding the non-communicability of syphilis to the lower animals. He succeeded at length in producing, on monkeys inoculated with chancre matter, a disease which had all the characters of a chancre. A disease was communicated to them capable of being transferred from them to rabbits, cats, and horses. It appears, also, that constitutional syphilis was established in these animals; and the chancres produced by inoculation became less and less in each animal, until at length a period arrived at which the virus seemed to lose all its power. No sores of any kind occurred. When a sore was established, however, in these animals, the virus was preserved, and was capable of transmission, and of re-transmission back to man. It was inoculated from a cat upon Dr. de Welz, a German physician and professor in University of Wurtzburg. On him it gave rise to a hard chancre, then to constitutional syphilis, demonstrating that the virus lost none of its virulence by the transference from man to animals, and from animals back to man. Nevertheless, Turenne believed that by prolonged inoculation the system became protected.

Sperino, of Turin, next took up the question. He inoculated persons suffering from syphilis by virus from a chancre, and repeated the inoculations once or twice a-week till the virus ceased to produce any effect; and when this point was reached, all other sores had healed. This naturally gave rise to the belief that, like vaccination, the system became protected; and to this process the name of Syphilization has been given.

The results at first sight are strange and incredible; and when we consider the suffering, the long confinement, the filthy sores, and the innumerable cicatrices left, as well as the doubtful results, the uncertain state of our knowledge regarding the virus of syphilis, and the media of its conveyance, it cannot be conceded that as yet we are warranted in sanctioning the method of treatment by syphilization. At Copenhagen, at Florence, at Turin, and other places where large hospitals exist, extensive experiments have been carried out in public; and although time and additional evidence are both wanted to learn ulterior results, nevertheless I think the facts are capable of a totally different explanation from that which has been given them; and to which I have adverted.

Sperino's cases and Lee's experience go to show that continuous suppurations and continuous suppurating sores in a patient suffering from secondary syphilis do not advance, but the disease does. Moreover, suppurations are easily established. The action set up in them by repeated inoculations with syphilization—is merely a continuous suppuration. Suppured sores are not produced. The system is not infected and the infecting virus will not produce any effect. Lastly, syphilis, in course of time, runs out of the constitution. Hence the method called syphilization may be explained, (1.) By continuous suppurations as a source of depuration to the system; (2.) By continuous suppurations as a source of ulceration being sufficient to accomplish the cure by the fact that the experiments on syphilization effected from all forms of venereal sores, do not taken indiscriminately from soft as well as from hard chancres.

The process to which the name of Syphilization consists of the following details:—

1. Matter is taken from a sore—an indurated ulcer.
2. A patient suffering with secondary syphilis.
3. From the pustules, which form in all stages of the disease, inoculations are made.
4. Every third or fourth day continue taking matter from the last pustule as long as it gives any result.
5. When it ceases to give any result new matter is taken from another primary indurated ulcer, and inoculations to be made as before on the sides of the neck.
6. When this ceases to take effect new matter is sought for and inoculated on the arms, and inoculations will succeed.
7. The operator is to go on inoculating matter until it will produce a pustule.
8. When no sores can be produced the process is complete; and all the symptoms of secondary syphilis then be found to have vanished.
9. During this process the diet must be

no wines or spirits being allowed. The artificial ulcers are to be covered with wet cloths, and the utmost cleanliness is necessary.

10. The mean time required to complete the cure is said to be four months (some say six months).

The very length of time implies a fallacy, for by lapse of time alone the disease, in some constitutions, is known to wear itself out (GAIRDNER); but the belief in the virtue of Syphilization appears to be based on a total misconception of the nature of the results obtained by the process; and on an erroneous interpretation of the facts which suggested the process. In other words, all the facts insisted on are capable of another and a totally different interpretation, as indicated above. It is also worthy of note that—

(1.) In the experiments on Syphilization all forms of the venereal poisons have been indiscriminately used.

(2.) The action set up is merely a continuous suppurative action. It is not alleged that the repeated inoculations produce indurated sores. Indeed, it is proved that once the system is contaminated, the infecting virus will not produce any specific effect so long as secondary symptoms (at least) continue.

(3.) Lee's cases, and others, show that if continuous suppuration is maintained the phenomena of secondary infection do not advance (page 39), but tend to wear themselves out; and that suppurations are easily set up in those contaminated.

(4.) The *modus operandi* of Syphilization is therefore explained—(a.) By lapse of time; (b.) By continuous suppurations (simple), affording a drain or source of depuration to the system.

Morbid Anatomy.—So varied are the effects of syphilis that a complete account of syphilis and its lesions has yet to be written; but it may be useful to illustrate some of the points of view from which the subject in its pathological bearings is now being examined, premising that it is necessary to *examine* the subject carefully—from year to year, as opportunity offers and as fresh facts add to our knowledge, being ever alive to the fallacies which inevitably surround the most patient investigations.

Hitherto, and even still, we may be led to suppose that *irregularity* is the rule in the development of syphilis; but as our knowledge gets more definite, the lesions are observed to follow a certain order and method of appearance, disturbed or protracted by various modifying circumstances, either of a constitutional kind or brought about by the action of curative agents.

From any one of the sources of infection already noticed, the later stages of syphilis are characterized by lesions which are distinguished from the earlier venereal affections, both by their situation and by their morbid anatomical peculiarities.

Differences in the stage of the disease have hitherto been mainly based upon the organs affected. The *primary affection* being local, the *secondary affections* or *stages* are those which involve the skin, the mucous membranes, the iris; while the *tertiary symptoms* or *stages* are supposed to implicate the areolar tissue, the bones, the muscles, the liver, the brain, the heart, lungs, and the kidneys.

A division based on the *anatomical* characters of the lesions seems to be more satisfactory than any arbitrary arrangement into stages of a supposed primary, secondary, or tertiary order (HALDANE).

1. In the so-called primary and secondary affections we have mainly to do with congestions, inflammations, and ulcers.

2. In the tertiary lesions and advanced stages of syphilis there is—(a.) A “constitutional cachexia” with certain definite anatomical characters; and (b.) A tendency to the growth of a peculiar material, chiefly in the form of gummatous tumors or nodules, of which the *node* is the common and familiar type; but which are found not only in the bones, but in the areolar tissue, the liver, the lungs, the heart, the brain, the muscles, the testicles, the eye.

With regard to the “constitutional cachexia,” it is necessary, if possible, to distinguish the degenerate nutrition brought about by “inherited” syphilis; as contrasted with that brought about by acquired syphilis.

The constitution of the person also materially influences the phenomena which supervene during syphilis—*e. g.*, gout, rheumatism, tuberculosis, cancer, modify the syphilitic lesions and degenerations; while constitutional syphilis in its turn modifies the character of ordinary diseases.

Persons with a tendency to rheumatism are apt to have the same tissues involved in syphilitic lesions as if he suffered from rheumatic inflammation. Hence syphilis is often set down as a cause of rheumatism. The serous, fibro-serous, white connective tissues are the sites of the lesion in the forms of periostitis, iritis, *corneitis*, and affections of the true skin.

In tuberculous patients those tissues are apt to be involved in the syphilitic lesions which are most prone to ulcerate, and to have tubercles grow in them. Hence syphilis is often set down as a cause of phthisis. The mucous membranes are most prone to suffer in such cases. Hence syphilitic growths develop themselves in the lungs, the glands and brain, pharynx, larynx, tonsils, tongue, and testicles.

In the gouty or vascular subjects the arterial or vascular structures and joints are apt to suffer most from the syphilitic virus, and the lesions are chiefly in the form of degenerations. Hence syphilis may be set down as a cause of disease in the great blood-vessels, leading to aneurisms; and of the smaller blood-vessels, leading to *amyloid degeneration* or waxy degeneration of the liver, kidney, spleen, and intestines.

The lesions in syphilis eventually assume a variety of anatomical forms, but in the first instance they are to be recognized in the typical forms of *nodes*, *gummata*, *tubercles* or *knots*, as *periostitis* and *inflammations of fibrous tissues*, tending to *caries*, *necrosis*, or *abscess*, or to *hypertrophy*, as in *exostosis*, and ultimately to cicatrices in various organs. Secondly, in degenerations, such as the amyloid (see page 114).

Gummata are the characteristic lesions of tertiary syphilis. They form growths which lead to the development of elastic tumors composed of a well-defined tissue, but with elements extremely minute. The gummatus tumor takes origin from the elements of connective tissue, or the analogues of such tissue, and hence the universality of the site of these lesions. They are like pus or an abscess in this respect.

When they first attract attention (as a node on the skin, or on the shin) they are small, solid, pale swellings, like a hard kernel, about the size of a pea. They may be generally first seen in true skin, or subcutaneous or submucous tissue; and where the tissue is lax they grow to a considerable size, and give a sensation to the hand as if filled with gum. Repeated examinations of this growth show that in the gelatinous condition it arises from a proliferation of nuclei in the cells of the connective tissue—like the formation of granulations in a wound. The component cells appear as round, oval, or oat-shaped particles, imbedded in a matrix of fine connective tissue, of a granular character, tending to fibrillation. The cells are a little larger than blood globules.

and contain granules in their interior when mature. In the young condition they are contained, and are seen to grow in groups, within the connective tissue corpuscles. In some respects they resemble tubercle, but differ thus in the mode of growth. How then do we recognize the nature of such growths?

First, taking the history of the case as a guide, we are led to conclude entirely from the anatomical character of the growth; and when such lesions are seen in a case with a distinct history of syphilis several questions suggest themselves for consideration. Is it the result of inflammation? Is it cancer or tubercle? Is it a syphilitic lesion? Are there traces of other similar lesions in the body? As a rule, *inflammation* leads to abscesses or hypertrophies of tissue or fibroid degeneration, and round all these syphilitic nodes we have such hypertrophy and degeneration, just as we have round tubercle nodules. Abscesses are easily recognized by the pus; and which, being altered by age, may still be anatomically recognized. *Cancerous* masses are recognized by the juice expressed from them. Here we have no juice; and the cell elements seen in cancer are characterized by the diversity of their form and growth. Here the elements are uniform in appearance and size, and form growths less highly organized than cancers, which tend to infiltrate and involve neighbouring textures, whereas the gummy node remains isolated.

By way of elimination or exclusion, therefore, we may thus come to recognize such growths as syphilitic—even without a history of syphilis (HALDANE).

They have been recognized now and described in all the solid viscera of the body.

The microscope has enabled us to study them with minuteness; but it is only their history, position, mode of appearance, structural elements, cause, and results, which enable us to recognize their true character.

Development and Course of the Syphilitic Node.—(1.) Proliferation goes on, and a glue-like mucous fluid forms, constituting the inter-cell material. The tumor, if near the surface, melts, opens, and ulcerates, thereby giving evidence of active or acute constitutional disease. (2.) The tumor continues gelatinous and coherent (if in dense parts, deeply seated), as in gummata of the periosteum, scalp, brain, liver, lungs, heart, thus giving evidence of constitutional disease, latent or inactive. (3.) Fatty degenera-

tion may occur in the tumor, which may eventually lead to its absorption; and this is the natural process of cure.

In the Bones these syphilitic lesions arrange themselves in *two* groups:—

1. The primary characteristic growths, or various states of gummata or nodes, which advance to the formation of ulcers; and the death of parts in little necrotic sloughs or cores of dead bone, imprisoned within circles of bone. There are usually several points of attack; and numerous bores or pores, with furrows converging to the centre, where the lesions first commence, giving rise to characteristic stellate depressions. Caries and necrosis of the bone follow the eating ulcers of soft parts, such as the roof of the palate, the nasal septum, the laryngeal cartilages; or caries and necrosis may follow periostitis of the long bones. Internal caries and necrosis may also occur, beginning in the marrow of the bone, giving rise to suppurating osteo-myelitis. Most of these forms of syphilitic lesions are to be seen in the skull bones, especially in the forehead and anterior parts of the skull. They may be seen as superficial or deep exfoliations of the outer laminæ. The deeper portions become dead in small circles, enclosed by new bone; or existing, like the core of a carbuncle, they cannot be removed without enlarging the aperture through which they make known their existence. The cicatrices which result after absorption or elimination of gummata in bone have a characteristic appearance, especially denoted by the want of growth in the centre, and activity of growth at the edges after loss of substance.

2. The virus of syphilis seems to have the power of fostering the growth of simple inflammatory products, and thus leading to *hyperostosis*, *exostosis*, and *hard nodes*.

In the Skin there are two groups of syphilitic lesions to be recognized,—(1.) Local growths; (2.) Cicatrices. The local growths occur in the superficial layer of the corion (VIRCHOW, BARENSPRUNG); and ultimately tend to grow deeper, and to affect more permanently the derma and subcutaneous tissue (A. T. THOMSON).

When such growths soften (as they tend to do when superficial), great destruction of tissue is the result; and the cicatrices are permanent and unseemly, and may follow without any abrasion of surface. This is especially the case in papular and tubercular forms of syphilitic skin diseases. The growth is

generally associated with effusion of fluid, which causes the hardness; absorption taking place, atrophy of tissue follows, and there is a falling in of textures, accompanied by obliteration of blood-vessels, and resulting in an unseemly white scar.

Affections of the Nails occur in two forms, namely, — (1.) As onychia; and (2.) As a dark red eruption on the nail, due to congestion of the vascular layer beneath, with numbness, and tingling beneath the surface. The nail atrophies, desquamation from its surface commences, and continues with splitting up of the substance, and pitting. Lastly, the nail crumbles down from the edges and free margin, point, or tip. It is irregular, and thickened from the under part (Psoriasis of the nail), analogous to the "Seedy toe" of horses. (Compare Richardson's very interesting paper in *Clinical Essays*, vol. i.)

In the substance of the heart, Virchow describes the syphilitic growth, and refers to cases of a similar kind recorded by Ricord and Lebert. Ricord, in his atlas, gives illustrations of them, and calls them "Syphilitic muscular nodes in the substance of the heart." (*Clinique Iconographique*.) Firm, yellow, cheese-like masses were found in the substance of the ventricles. There was a history of old chancres and ulcerated tubercles of the skin.

In Lebert's case these gummata were seen at a comparatively early stage of development, and were found in the wall of the right ventricle. There were tubercles of the skin, of the subcutaneous tissue, genital organs, and bones of the skull (*Anat. Pathologique*). In Virchow's case there were syphilitic gummata in the testicles.

Dr. Haldane records a case of a similar kind, and gives excellent drawings in *Edin. Monthly Med. Journal* for Nov., 1862.

In the Museum of the Army Medical Department at Netley there are two preparations which show such gummata in the substance of the heart. One occurred in the case of a soldier, twenty-four years of age, under treatment for venereal ulcers of nine months' duration, on various parts of the body. He had lost his palate, and eventually sunk from exhaustion, with symptoms of phthisis. Sections of the muscular substance of the heart showed several isolated deposits in its substance and beneath its serous covering; and isolated portions of the lungs were converted into a substance of the consistence of cheese.

In the Brain such gummatous tumors have been especially

described by Bonet, Ricord, Cullerier, and Lallemand. Ricord describes them under the name of the syphilitic tubercle of the brain. Dr. Steenberg (physician for the insane at Schleswig) believes that a great proportion of the syphilitic affections of the brain are subsequent to lesions of the arteries, and the organs of circulation generally he observes to be the frequent seat of syphilitic localizations. Hence softening of the cerebral substance, and various lesions of the nervous system, are by no means rare in cases of prolonged syphilis; and Virchow has frequently noticed lesions of the great vessels in those who die from syphilis with lesions in the brain. The tendency to aneurismal dilations and cicatricial-like loss of substance in the lining membrane of the great vessels, in young subjects who are severely affected with syphilis, is a subject in morbid anatomy which requires yet to be investigated.

In the cases where cerebral symptoms have long co-existed with syphilis "a quantity of tough, yellow, fibrous tissue unites together the surface of the brain with the adjacent membrane, and this again is adherent to the bone. The cortical substance of the brain at the affected spot is often partly destroyed, and the adventitious material occupies its place. The question has still to be solved as to what structure is primarily affected. Many have given the authority of their name to the opinion that the disease commences first in the bone, but simply for the reason that the osseous system is that which has so long been recognized as liable to be affected. But since we now know that other structures may be similarly attacked, we are prepared to look for its commencement in other parts, and even in the brain structure itself. . . . The cases which are so frequently met with are those where the deposit involves both sides of the *dura mater*, and includes in it the bone on one side and the brain on the other. The probabilities are in favour of its occurring in the *dura mater* first, as it arises in the periosteum on the exterior of the cranium." (Wilks in *Med. Times and Gazette*, Oct. 25, 1862.)

But the lesion also occurs in isolated gummatous nodules in the great nervous centres, such as the *Thalami optici* or *Corpora striata*. I saw very recently (29th May, 1863) a most interesting dissection of such a case in the Middlesex Hospital, which had been under the care of Dr. Goodfellow. There had been a history of syphilis, and some of the children of the man had

died of inherited secondary syphilitic lesions. A gummatous tumor occupied the left *optic thalamus*. Numerous cases of syphilitic tumor of the nerves and nervous centres are to be found collected together in the pages of the *Medical Times and Gazette*, and two may be referred to of the intra-cranial nerves, related in the 17th vol., for 1858, p. 419, in each of which paralysis was due to such syphilitic *neuromata*.

The lesions of encephalic syphilis are ushered in by obscure phenomena; but the following may be especially noticed:—*Insomnia* manifests itself at the commencement; and the *headache* is characterized by—(1.) Violence; (2.) Prolonged duration; (3.) Nocturnal recurrence or exacerbation. The *general nervous symptoms* are especially obvious in alteration of intelligence, of sensibility, and of motion. These, combined with such obvious local lesions as caries, or necrosis of the facial bones or of the cranium; or tumors on the external surface of the cranium, such as gummata, periostitis, or exostosis, at once point to cerebral syphilitic lesions; which are sometimes expressed by persistent epilepsy.

Any form of syphilitic infection may be followed by nervous affections, from a year old up to old age.

The syphilitic brain disease generally leads to *softening* of cerebral substance surrounding the nodule; and this softening cannot be distinguished from the softening induced by any other cause.

The duration of the syphilitic nervous affections averages about one year; and their natural course is characterized by intermissions; and at the outset the intermissions are very distinctly expressed.

A point in the pathology of syphilis, at present assuming considerable importance, is the influence which an open suppurating sore of a secondary or tertiary kind has in removing the tendency to the localizations of lesions elsewhere, and especially in internal parts. Dr. Steenberg says, with reference to cerebral lesions, that he has seen the existence of an ulcer of a tertiary kind act as a natural issue in subduing the irritation of cerebral lesions, an entire remission of the nervous symptoms occurring while the ulcer remained open. Hence the great benefit which often follows the use of a seton in syphilitic epilepsy.

Mr. Henry Lee also writes that "fresh inoculations from suppurating sores during the time of their development check the

activity of other lesions of the skin;" and, no doubt, of lesions elsewhere. Hence the reputed good effects of the filthy process of syphilization may in some degree be explained by these facts, as in cases where syphilization has been continued during several or many months.

The syphilitic lesions capable of affecting directly or indirectly the sense of sight are numerous and various. These involve either the optic nerve itself or the constituent parts of the eye—*e. g.*, *choroditis*; diffuse exudation throughout the *retina*; atrophy of the *optic nerve* and its *papilla*, with diminution in the calibre of the central vessel; circumscribed abscesses, or partial softening developed in the course of the optic nerve (VON GRAEFE).

The syphilitic lesions in the lungs have been long ago described by Morton, Sauvage, Portal, Morgagni, and more recently by Graves, Stokes, Walshe, Wilks, Virchow, Ricord, and Munk.

Two forms of syphilitic lesions of the lungs are recognizable,—(1.) *Bronchitis*, or bronchial irritation at least, with fever, in many cases precedes the skin lesions, and disappears wholly or partially when this is established; and if the syphilitic eruption suddenly disappears, bronchitis may again ensue (WALSHE). The patient may thus have all the symptoms of phthisis, yet no tubercle in the lung. The tendency of syphilis is thus to induce phthisis in those especially constitutionally predisposed, and where mercury has been taken. Periostitic thickening of the clavicle and the upper ribs is apt to lead to the belief that tubercle is present, on account of the consolidation. Care is necessary in the case of young soldiers; who, having been just discharged from hospital after the cure of an infecting chancre, may be exposed to cold and wet on guard, and so have an attack of syphilitic bronchitis induced—the probable commencement of a growth of tubercles in the lungs, or of solitary syphilitic gummata. (*Annual Report of Army Med. Depart. for 1861.*) (2.) Deposit in the pulmonary substance, in the form of gummata, of the same histological constitution as the well-known subcutaneous product which has been described by M. Ricord and M'Carthy as forming in the lungs, especially towards their periphery and bases. Towards the periphery they are like nodules of lobular pneumonia. They soften, and are eliminated very much like tubercle, and have at first a consistence like scirrhus. They are non-vascular (WALSHE).

Syphilitic Lesions of the Liver.—Dittrich and Gubler were the first to give an accurate description of these syphilitic deposits in the liver. Virchow has also described a peri-hepatic lesion and a simple gummy interstitial hepatitis. The former never occurs alone, but is generally associated with the latter. The hepatic substance atrophies, and the deposit contracting is eventually absorbed, causing a cicatrix-like mark. The liver lesions are usually among the later symptoms of syphilis, and are well described by Wedl, Virchow, Wilks, and Frerichs.

The Syphilitic Lesions of the Testicles have been minutely examined by Virchow and Wilks. Where the general substance of the testicle is affected the deposit is interstitial, and the free portion of testicle is first attacked; then the tunica albuginea thickens, and the inflammation extends along the tubes.

The middle cones of the testicle are most frequently affected, and they increase in size from proliferation of tissue elements. The interstitial tissue softens and is red, the tubes thicken, fatty epithelium becomes developed, and atrophy results. Solitary nodules may sometimes form, varying in size from a millet seed to a cherry. They look like yellow tubercle, and are analogous to the gummata observed in the scrotum and in the substance of the tongue, which are hard and elastic, about the size of a pea, and easily overlooked. These tumors in the testicles and tongue are peculiar, in not growing from a centre, like other tumors, but rather as infiltrations of tissue (WILKS). Thus they are not perfectly circumscribed, but are found mixed up with the adjacent tissues.

Lesions of the Tongue of a syphilitic nature are to be seen in many of these cases. They are mostly expressed by ulcerations at the base, often in such positions that the laryngoscope only can disclose them to view. Sometimes they appear as a raw, indolent, abraded-like surface, in circumscribed patches, on the dorsum or edge of the tongue—the aphthous exfoliation and syphilitic tubercles of Erasmus Wilson (see Plate 3, fig. E, of his work on syphilis).

Treatment of Syphilis.—As in the case of other *enthetic* diseases, it is clear that if the inoculation of the syphilitic virus could be recognized in time, the site of inoculation, and with it the virus, by being destroyed, subsequent infection of the system might be prevented; but experience shows we must not conclude that even

by an early destruction of the sore the occurrence of constitutional infection will be always prevented. The exact nature of a sore cannot yet be recognized at a sufficiently early date (apart from all other means of diagnosis), as to whether it will or will not prove a sore carrying a virus which will infect the system. In cases where the sore is a suppurating one, *occurring late after* exposure to infection, such a sore may be of a mixed nature, and therefore is of doubtful character and always suspicious. The progress of such sores may be arrested with escharotics; and the only efficient caustics for this purpose are—(1.) The *strong nitric acid*; or (2.) The *potassa cum calce* (most conveniently used in the form of small sticks). *Nitrate of silver* is useless, from its limited action and deficiency of penetration. If the sore threatens to slough, the parts should be wiped dry and *nitric acid* applied; and afterwards a lotion of the *potassio-tartrate of iron*, while the same drug is given internally. *Chloride of zinc* paste (FELL'S) is a useful escharotic to excite a healthy action round the periphery of a sore. If great pain attends the local progress of the chancre, *morphea* in *liquor ammonia acetatis* is highly beneficial.

Mercury has been said and been believed to be able to prevent, or at least to delay, the accession of the constitutional infection and the secondary lesions of syphilis. It seems, at all events, to be one of those agents which are able to break the regular order of the manifestation of symptoms, as it does to several other diseases; although it may not seem to possess any certain prophylactic power.

There are remarkable variations in opinion as to its influence in curing syphilis. At one time discussion ran high regarding its use; and of course extreme statements were made on both sides, while the facts adduced never warranted the extreme conclusions.

Consequently, at one time mercury has been regarded as capable of absolutely preventing the constitutional affection; at another time it has been accused of giving to the syphilitic virus the impulse which sets up the constitutional affection. It is now quite certain, however, that mercury administered continuously to the extent of salivation, or approaching it, exerts a poisonous influence, and produces constitutional effects very similar to those produced by syphilis (GRAVES); and Hunter himself says "new diseases arise from mercury alone;" while it cannot be doubted

that, in cases in which mercury has been freely given, we are never certain that secondary symptoms may not supervene. Bürensprung, of Berlin, during his most extensive experience, has come to the conclusion that syphilis not only can be cured without mercury; but he avows that under its use the disease is often rendered latent for months and years, and its complete cure delayed. He is of opinion that mercury deteriorates the constitution, and favours the development of destructive local affections. The non-mercurial treatment is slower, but surer; starvation and Zitmann's decoction being the means he employs. He believes that the proportion of cases of constitutional syphilis to those of chancre has greatly diminished since mercurial treatment has been discontinued. (*Ann. de Berlin Charité*, ix, 1, 1860; *Syden. Soc. Year-Book*, 1861.) Herman has come to similar conclusions from his experience in the syphilitic wards of the Vienna Infirmary. He believes that the non-mercurial treatment is much more speedy and successful than the mercurial—that no relapses occur; and that cutaneous eruption is much more frequent and severe in patients who have taken mercury. The experience of Diday is not less decided. He states that mercury cannot now be said to cure syphilis radically, so as to render all relapse impossible. Its warmest advocates do not, in the present day, claim more for it than the power of delaying only the appearance of the first syphilitic manifestations, and of hastening the disappearance of certain other lesions. He imputes to it positively, and on sufficient clinical evidence, the following disadvantages:—1st. It tends to render the primary ulcer phagedenic; 2nd. It tends to induce *stomatitis* and *necrosis* of the alveolar borders; 3rd. It produces an acute affection of the gastro-intestinal mucous membrane, and dyspepsia; 4th. It brings on trembling of the extremities, apoplexy, and insanity. All of these results he has seen supervene, even when the treatment by mercury was superintended and directed by the most competent and attentive practitioners.

He does not, however, withhold mercury in every case. If the primary lesion is an indurated, *woody* chancre, mercury is to be given. If the chancre is a doubtful one, he recommends waiting till some of the early constitutional phenomena render the nature of the case evident, and indicate the probable gravity of the syphilis with which he has to deal. He employs *iodine*,

iron, and quinine, on the appearance of slight relapses, with a tonic and supporting regimen. He recommends *iodides* to combat the *chloro-anæmia*, and to relieve the pain of tertiary ulcerations.

Numerous examples may be seen in museums which show that the poisonous effects of mercury produce the worse lesions of the two; and, when combined with the syphilitic virus, the worst of all. In the extreme of syphilitic infection, it ought never to be forgotten that a specific chlorosis results from syphilis amounting to anæmia; and that mercury will bring about a similar anæmia; while numerous instances are quoted by authors of the poisonous effects of mercury inducing lesions similar to those of syphilis.

Both kinds of treatment (mercurial and non-mercurial) have been extensively tried since 1816, and formal experiments have been organized on the subject, namely, *First*, In 1822 in Sweden, by Royal command, when reports were annually furnished from civil and military hospitals as to trials of the two methods; *Second*, Dr. Fricke experimented in the Hamburg General Hospital, and published his results in 1828; *Third*, In 1833 the French Council of Health published a report on the subject.

From all these accounts more than 80,000 cases were submitted to experiment, and they go to show that syphilis is cured in a shorter time, and with less chance of constitutional effects, by the simple than by the mercurial treatment.

It is extremely interesting and gratifying to be able to say that long before any of these reports were initiated, the surgeons of the British Army perceived the ravages of the combined poisons of mercury and syphilis; and had the boldness to declare themselves against the system of treatment with mercury, and to introduce the milder measures of non-mercurial treatment.

The credit of this improvement is mainly due (1.) To Mr. Ferguson, who practised it during the Peninsular wars (*Med.-Chir. Trans.*, vol. iv.); (2.) To Mr. Rose, of the Coldstream Guards, at the same time, but independently of Mr. Ferguson; (3.) To Dr. John Thomson, the first Professor of Military Surgery; who, by lectures and writings, was mainly influential in convincing Scotch medical men of the evil effects of mercury in venereal diseases.

Mercury, however, seems to be still much more extensively

employed in England and Ireland than it is in Scotland; and for many reasons the inquiry begun in 1816, by these military surgeons, requires to be re-investigated with all the present advanced knowledge of the nature of the disease which we now possess, and with a better prospect of detecting the fallacies which surround the investigations. No confidence can now be placed in the results derived from clinical observation, where the cure of soft, suppurating, and mixed sores, gonorrhœa, vegetations, suppurating buboes, are all indiscriminately given as evidence of the cure of syphilis; and cases cannot be accepted as cured at the time they are simply discharged from present treatment, because they may seem to be progressing to a favourable termination, but not absolutely cured.

The present position of opinion with regard to mercury in the cure of syphilis seems to be this:—namely, that it is a very valuable remedy in some cases more than in others; and the difficulty is to express the nature of the cases for which it is most suitable. Even those who believe most fully in its virtues acknowledge that in primary affections its administration rarely, if ever, prevents the occurrence of constitutional symptoms; while for the secondary lesions it will be found that relapses and slow recoveries are the rule, and a rapid return to health the exception (MARSTON). If the primary sore, therefore, can be healed by local remedies, it is unwise to administer a remedy of acknowledged doubtful efficacy as a preventive to the appearance of secondary phenomena, which may never occur. There are also certain forms of secondary syphilis for which the administration of mercury is unsuitable. These are, the pustular eruptions, or ecthymatous states in rupia and in syphilitic anæmia. For the cure of other secondary symptoms mercury may be of service. Dr. Jeffery Marston, of the Royal Artillery, has given an admirable summary (*British Medical Journal* of Feb. 21, 1863) of the means and indications of treatment by mercury which he has found most useful. His experience shows that the system ought to be affected as slowly as possible, and there ought to be a remission of the remedy for a time as soon as that effect has been attained. As soon as the symptoms for which the mercury was given have disappeared, steel and other remedies ought to be given; and in three cases where the general health seemed to have suffered, *podophyllin* in small doses (one-sixth of a grain), with extract of

belladonna, was given with marked benefit. If the system is too early brought under the influence of mercury, and the symptoms are not benefited, *chlorate of potash* in *compound tincture of cinchona* may be given with advantage; and in strumous subjects, the *bichloride of mercury*, dissolved in *ether*, and added to *cod-liver oil*, is found to be most useful. Some of the more intractable forms of syphilitic *squama* are best treated by a combination of *liquor arsenicalis*, solution of *bichloride of mercury*, and tincture of *sesquichloride* of iron; while the use of soap in ablution ought to be avoided (STARTIN).

Iodide of potassium, in doses adjusted to the individual case, appears to act with rapid benefit in some of the syphilitic diseases of the interior of the cranium, giving rise to extreme pain. The administration of iodide of potassium often causes intense suffering in patients who have been treated by mercurials. Two distinct effects are produced: *first*, the compounds of mercury fixed in the body are rendered soluble and active; and, *secondly*, a form is given to them which allows of their elimination, with more or less rapidity, in a state of combination with one of the elements of the iodide; and thus the patient is subjected anew to a mercurial treatment by the compounds of mercury already present in his body. (Melsens in *Brit. and For. Med.-Chir. Review*, 1853.) The dose of *iodide of potassium* should at first be small—not more than *fifteen grains* in the twenty-four hours—increasing the dose, if the patient bears it well (MELSENS, GUILLOT). Its action is aided by a blister over some portion of the shaven scalp, and by having the blistered surface dressed with mercurial ointment; and, generally, it may be said that local treatment gives very valuable aid. For example, cutaneous or mucous *raised papules* remaining persistent, an ointment composed of *oxide of zinc*, *calomel*, and *simple cerate*, hastens their absorption. Eruptions of lichen, acne, and herpes, are similarly benefited by the application of *oxide of zinc lotion* or *ointment*; and if *prurigo* and *urticaria* be also present, *diacetate of lead lotion* will expedite the cure. Vesiculo-crustaceous spots will cease to re-appear if the affected parts are painted for a few days with a solution of *nitrate of silver* (gr. x.—xx. to ʒi.), and *oxide of zinc lotion* applied afterwards.

In the dry forms of syphilitic cutaneous diseases, and in *chronic eczema* of the extremities, tar ointment, or an alcoholic solution

of tar, is an excellent application; and the disappearance of indolent glandular swellings is greatly aided by the use of strong solutions of iodine. Superficial forms of ulceration attending the pustules of *ecthyma* are benefited by the use of solutions of *nitrate of silver* or *sulphate of copper*, and generally by caustics and local stimulants. If a sloughing condition threaten ulcerating sores, lotions of the *potassio-tartrate of iron* will generally improve their aspect. In *psoriasis palmaris*, and similarly fissured conditions of the skin, *glycerine lotions* are most useful. But all these local remedies, it must be remembered, are only aids to the constitutional treatment, whether by mercury or iodide of potassium, or simply by a well-regulated hygiene. The patient, during the whole of the treatment, should be warmly clad—should be fed upon a good but plain diet—should take plenty of exercise in the open air—should use occasionally (once or twice a-week) warm baths—and avoid stimulants, unless specially indicated and prescribed.

The administration of mercury, to affect the system, is best effected through the agency of the mercurial vapour bath. It is a mode of administration not liable to affect the digestion, and it permits other remedies to be given by the mouth at the same time, if they be considered necessary. It is also mild, slow, and equable in its action,—so that it is safer than many other plans. The mercurial vapour bath is to be managed in either of the following ways. The first method is best adapted for the practice of a large institution; the method recommended by Mr. Lee is better suited for private practice:—

“The patient is seated on a chair, and covered with an oil-cloth lined with flannel, which is supported by a proper framework. Under the chair are placed a copper bath, containing water, and a metallic plate, on which is placed from one to three drachms of the bisulphuret of mercury, or the same quantity of the grey oxide, or the binocide of this metal. From five to thirty grains of the iodide of mercury may be employed, or a scruple of the iodide, with a drachm and a half of the bisulphuret. Under the bath and plate spirit-lamps are lighted. The patient is thus exposed to the influence of three agents,—heated air, steam, and the vapour of mercury. At the end of five to ten minutes perspiration commences, which becomes excessive in ten or fifteen minutes longer. The lamps are now to be extinguished; and when the patient has become moderately cool, he is to be rubbed dry. He should

then drink a cup of warm decoction of guaiacum or sarsaparilla, and repose for a short time" (LANGSTON PARKER).

Mr. Henry Lee's mode of proceeding is more simple:—"A special and convenient apparatus is used (made by Savigny & Co.), which consists of a kind of tin case, containing a spirit-lamp. In the centre, over the flame, is a small tin plate, upon which from fifteen to thirty grains of calomel is placed, while around this is a sort of saucer, filled with boiling water. The lamp having been lighted, the apparatus is placed under a common cane-bottomed chair, upon which the patient sits. He is then enveloped, chair and all, in one or more double blankets, and so he remains, well covered up, for about twenty minutes, when the water and mercury will be found to have disappeared."

The *bichloride of mercury* is perhaps the next best form of administration; and where it has to be continued over many weeks, may be given in the following form, with opium (TANNER):—

R. Hydrargyri Bichloridi, gr. ii. ; Pulveris Opii, gr. v.-viii. ; Pulveris Guaiaci, ʒss. ; *misce*; Fiat. Pilulæ, xvi. One, twice or thrice a-day.

With regard to *sarsaparilla* as a remedy, Sigmund, Syme, and many other acute observers, have come to the conclusion, after long and careful trials of the best sarsaparilla, that it does not exercise the slightest perceptible influence on the course and termination of syphilitic diseases.

CHAPTER VIII.

ON THE NATURE OF THE ACUTE SPECIFIC OR GENERAL DISEASES.

THE two orders of zymotic diseases which have now been described constitute a group of diseases sometimes termed "*acute specific*" (WALSHE) or "*general diseases*" (WOOD), because they primarily and essentially implicate the entire system. Throughout their course, and from the first, they each variously modify the composition of the blood, the calorification and the innervation of the body. Each and all of them, also, during their progress, give rise to some lesions in the textures of a special

anatomical character, when the disease is not too rapidly fatal to allow of these pathological features to become developed, as in *yellow fever, typhoid fever, plague, cholera*. These maladies run an acute and rapid course, they are more or less pyrexial, and, in the majority of instances, the fever which accompanies them has a fixed duration. The greater number of them are contagious under certain conditions not yet well understood; and lastly, all of them are produced by an extrinsic poison, either of a *miasmatic* nature, as in those of the first order; or by the implanting of a *specific virus*, as in those of the second order.

The *specificity*, so to speak, of these diseases, consists in certain characters which distinguish each of them from any other disease; and in the constancy by which, for time immemorial, such characters have continued to distinguish them. Although medical opinions regarding their pathology may change, yet the essential characters of these "*acute specific diseases*" are not known to change. Each of these diseases observes a constancy and regularity of plan in the construction and development of its morbid processes (PAGET). Each of them has some essential character or characteristics by which they are severally distinguishable. The course of the febrile phenomena are found to be distinctive, the duration of the febrile state not less so, as well as the anatomical signs which distinguish the local lesions, the development of which are concurrent with the general or constitutional phenomena. With regard to their causes, each of them appears to be produced by some distinct morbid agent—some morbid poison—a poison or virus which is capable of being multiplied in the body during the development of the particular disease. In this respect they are capable of self-augmentation (PAGET). No evident fresh cause is applied, and yet the disease increases (*e. g., syphilis, small-pox, vaccinia, glanders, hydrophobia, malignant pustule*). The theory of each of them, expressed in the most general terms, is, that each of them depends upon a definite specific virus which induces a morbid condition of the blood; and that, during the development and course of the disease, the system endeavours to discharge or transform in some way the peculiar morbid agents which have given rise to the disease, or which have multiplied in the body during the course of the disease. The whole blood then seems to be diseased, and nearly every function and sensation in the frame is impaired or dis-

turbed from the state of health before any local lesion is developed. Sometimes, indeed, the severest constitutional disturbances of a specific kind may co-exist with the smallest local development of any specific lesion (PAGER); and Dr. Robert Williams has justly observed, and numerous examples have been noticed, in which "it may be laid down as a general law, that when a morbid poison acts with its greatest intensity, and produces its severest forms of disease, fewer traces of organic alterations of structure will be found than when the disorder has been of a milder character. Time, duration, or *chronicity*, is a peculiarly important and characteristic element in the nature of these diseases. They run a definite course; and we know of no specific remedy which will at once effect a cure and prove an antidote to the poison. The nearest approach to an antidote is that of quinine in the malarious fevers. They have all (1.) A more or less defined period of incubation or latency; (2.) A period of development towards the *fastigium* or acmé of the disease; (3.) A period of *defervescence*, during which the febrile phenomena abate; and, lastly, a period of convalescence.

END OF VOL. I.



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